

Radio- Electronics®

**4 EASY-TO-BUILD TOYS
FOR THE HOLIDAY SEASON**

\$1.25 DEC. 1981

48783

Radio Moscow and the dB War
Videotex for TV: How it works
Etch your own PC boards

Choosing the right cassette tape
Build a hi-fi mini-speaker
How to align TV color circuits



**BUILD YOUR OWN
HI-FI CX DISC DECODER**

Kevin Tanne

ON APRIL 24TH 1981 A PROFESSIONAL INDEPENDENT TESTING LABORATORY PROVED K40 THE HIGHEST PERFORMANCE RADAR DETECTOR IN THE WORLD!

1 ESCORT, WHISTLER, FOX, JR. MICROWAVE, SUPER SNOOPER AND FUZZBUSTER ALL COMPETED IN THE CONTEST.

2 THE BRAND NEW K40 RADAR DETECTOR USING A UNIQUE WAVE GUIDE COUPLED DIE CAST ANTENNA DETECTED X BAND RADAR AN AVERAGE OF 54% FURTHER THAN ALL OTHER DETECTORS AND 67% FURTHER ON THE K BAND FREQUENCY.

OUTPERFORMS ESCORT

THE K40 OUTPERFORMED THE ESCORT 17% ON K-BAND AND 34% ON X-BAND. THE K40 AVERAGED 28% MORE DISTANCE THAN ESCORT AND 60% FURTHER THAN ALL OTHERS COMBINED.

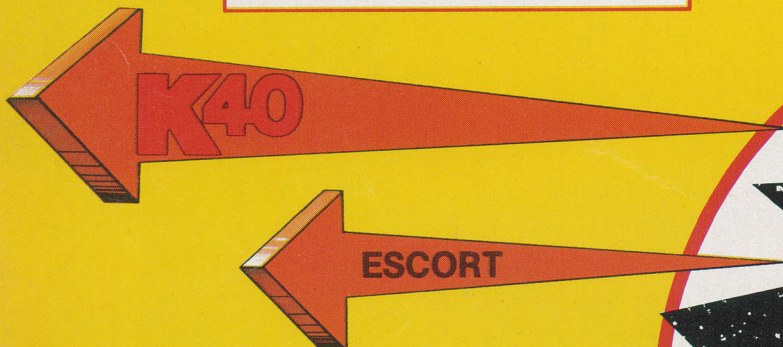
3 HERE'S THE TEST* THAT PROVED IT!

TEST RESULTS	
MANUFACTURER	COMBINED X & K-BAND DISTANCE FROM GUN
K40	296 MILES
ESCORT	230 MILES
GUL	228 MILES
BEL	252 MILES
RADAR INTERCEPTOR	192 MILES
WHISTLER Q1000	143 MILES
AUTOTRONICS	130 MILES
FOX	125 MILES

THEIR TEST—NOT OURS!



*April 24, 1981 TKI International



\$380⁰⁰

IT COSTS MORE BECAUSE IT'S MADE BETTER!

DOUBLE GUARANTEE

GUARANTEE 1: We're so convinced our K40 Radar Detector will intercept Police Radar Better Than Any Commercial Radar Device, we'll allow you to test our K40 in your car for 7 days... if not satisfied with its performance, return to your K40 dealer who installed it for a prompt and full refund.

GUARANTEE II: Unconditionally guaranteed for 12 months. Guaranteed against cracking, chipping or rusting. Guaranteed against mechanical failure. Guaranteed against electrical failure. No exclusions. No gimmicks. For a FULL 12 MONTHS.



K40
THE WORLD'S
HIGHEST
PERFORMANCE
RADAR DETECTOR

CALL 800-323-5608
FOR THE DEALER NEAREST YOU.

AMERICAN
ANTENNA

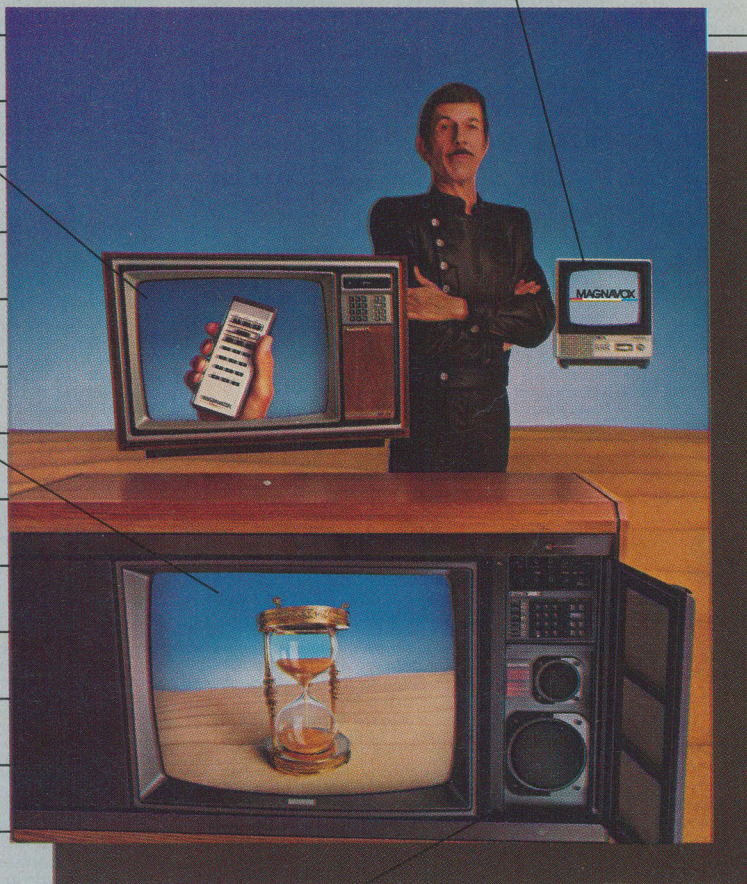
ELGIN, ILLINOIS 60120
©COPYRIGHT AMERICAN ANTENNA

... Sold exclusively by **3500** American **K40** CB Dealers throughout the U.S. & Canada.
CIRCLE 55 ON FREE INFORMATION CARD

*Magnavox model 4012,
9-inch diagonal measurement
AC/DC color portable
with electronic tuning wheel
and dial scale indicator.*

*Magnavox model 4265,
19-inch diagonal measurement
Star System. All Star System
sets give you infrared remote
control, 105 channel capability,
automatic switching between
two channels, display time
of day and channel number
on TV screen.*

*Magnavox. A picture you
can rely on time after time.*



*Magnavox model 5260,
25-inch diagonal measurement
Star System. This set even
has expanded range
high-fidelity sound.*

TV pictures and wood-grain cabinets simulated.
All models shown are Star Systems except model 4012.

TELEVISIONARY.

Magnavox sees the next stage of televising with you as the participant as well as the recipient.

For that, you will need the most reliable color television possible.

And now Magnavox Star® System color television sets combine advanced design concepts, high technology and new manufacturing systems to deliver the highest level of reliability in Magnavox history.

Magnavox. Television as visionary as tomorrow. With a picture as reliable as it is bright and clear.

Time after time.

MAGNAVOX

The brightest ideas in the world are here today.

Synthesized Hand-Held Scanner!

Chances are the police, fire and weather emergencies you'll read about in tomorrow's paper are coming through on a scanner right now. All scanners sold by **Communications Electronics** bring the real live excitement of action news into your home or car. With your scanner, you can monitor the exciting two-way radio conversations of police and fire departments, intelligence agencies, mobile telephones, energy/oil exploration crews, drug enforcement agencies and more.

Some scanners can even monitor aircraft transmissions! You can actually hear the news *before* it's news. If you do not own a scanner for yourself, now's the time to buy your new scanner from **Communications Electronics**. Choose the scanner that's right for you, then call our toll-free number to place your order with your Master Card or Visa. A scanner is an excellent holiday gift.

We give you excellent service because **CE** distributes more scanners worldwide than anyone else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are **in stock** for quick shipment, so if you're a person who prefers fact to fantasy and who needs to know what's *really* happening around you, order your scanner today from **CE**!

NEW! Bearcat® 350

The Ultimate Synthesized Scanner!

Allow 30-60 days for delivery after receipt of order due to the high demand for this product. List price \$599.95/CE price \$419.00

7-Band, 50 Channel • Alpha-Numeric • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz. The new Bearcat 350 introduces an incredible breakthrough in synthesized scanning: Alpha-Numeric Display. Push a button—and the Vacuum Fluorescent Display switches from "numeric" to word descriptions of what's being monitored. 50 channels in 5 banks. Plus, Auto & Manual Search, Search Direction, Limit & Count. Direct Channel Access. Selective Scan Delay. Dual Scan Speeds. Automatic Lockout. Automatic Squelch. Non-Volatile Memory. Reserve your Bearcat 350 today!

Bearcat® 300

List price \$549.95/CE price \$339.00

7-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz. The Bearcat 300 is the most advanced automatic scanning radio that has ever been offered to the public. The Bearcat 300 uses a bright green fluorescent digital display, so it's ideal for mobile applications. The Bearcat 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.



NEW! Bearcat® 350

Bearcat® 250

List price \$429.95/CE price \$269.00

6-Band, 50 Channel • Crystalless • Searches Stores • Recalls • Digital clock • AC/DC Priority Channel • Delay • Count Feature Frequency range 32-50, 146-174, 420-512 MHz. The Bearcat 250 performs any scanning function you could possibly want. With push button ease you can program up to 50 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear. A special search feature of the Bearcat 250 actually stores 64 frequencies and recalls them, one at a time. Overseas customers should order the Bearcat 250FB at \$379.00 each. This model has 220 V AC/12 V DC power supply and 66-88 MHz low band coverage.

NEW! Bearcat® 20/20

List price \$449.95/CE price \$279.00

7-Band, 40 Channel • Crystalless • Searches AM Aircraft and Public Service bands • AC/DC Priority Channel • Direct Channel Access • Delay Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz. The Bearcat 20/20 automatic scanning radio replaces the Bearcat 220 and monitors 40 frequencies from 7 bands, including aircraft. A two-position switch, located on the front panel, allows monitoring of 20 channels at a time.

Bearcat® 210XL

List price \$349.95/CE price \$219.00

6-Band, 18 Channel • Crystalless • AC/DC Frequency range: 32-50, 144-174, 421-512 MHz. The Bearcat 210XL scanning radio is the second generation scanner that replaces the popular Bearcat 210 and 211. It has almost twice the scanning capacity of the Bearcat 210 with 18 channels plus dual scanning speeds and a bright green fluorescent display. Automatic search finds new frequencies. Features scan delay, single antenna, patented track tuning and more!

Bearcat® 160

List price \$299.95/CE price \$184.00

5-Band, 16 Channel • AC only • Priority Dual Scan Speeds • Direct Channel Access Frequency range: 32-50, 144-174, 440-512 MHz. Would you believe...the Bearcat 160 is the least expensive Bearcat crystalless scanner.

This scanner presents a new dimension in scanning form and function. Look at the smooth keyboard. No buttons to punch. No knobs to turn. Instead, finger-tip pads provide control of all scanning operations, including On/Off, Volume and Squelch. Of course the Bearcat 160 incorporates other advanced Bearcat features such as Priority, Direct Channel Access, Dual Scan Speeds, Lockout, Scan Delay and more.

NEW! Bearcat® 100

The first no-crystal programmable handheld scanner.

Allow 60-120 days for delivery after receipt of order due to the high demand for this product. List price \$449.95/CE price \$299.00

8-Band, 16 Channel • Liquid Crystal Display Search • Limit • Hold • Lockout • AC/DC Frequency range: 30-50, 138-174, 406-512 MHz. The world's first no-crystal handheld scanner has been compressed into a 3" x 7" x 1 1/4" case more scanning power than is found in many base or mobile scanners. The Bearcat 100 has a full 16 channels with frequency coverage that includes all public service bands (Low, High, UHF and "T" bands), the 2-Meter and 70 cm. Amateur bands, plus Military and Federal Government frequencies. It has chrome-plated keys for functions that are user controlled, such as lockout, manual and automatic scan. Even search is provided, both manual and automatic. Wow...what a scanner!

The Bearcat 100 produces audio power output of 300 milliwatts, is track-tuned and has selectivity of better than 50 dB down and sensitivity of 0.6 microvolts on VHF and 1.0 microvolts on UHF. Power consumption is kept extremely low by using a liquid crystal display and exclusive low power integrated circuits.

Included in our low CE price is a sturdy carrying case, earphone, battery charger/AC adapter, six AA Ni-cad batteries and flexible antenna. For earliest delivery from CE, reserve your Bearcat 100 today.

Bearcat® 5

List price \$134.95/CE price \$94.00

4-Band, 8 Crystal Channels • Lockout • AC only Frequency range: 33-50, 146-174, 450-508 MHz. The Bearcat 5 is a value-packed crystal scanner built for the scanning professional — at a price the first-time buyer can afford. Individual lockout switches. Order one crystal certificate for each channel.

Bearcat® Four-Six ThinScan™

List price \$189.95/CE price \$124.00

Frequency range: 33-47, 152-164, 450-508 MHz. The incredible, Bearcat Four-Six Thin Scan™ is like having an information center in your pocket. This four band, 6 channel crystal controlled scanner has patented Track Tuning on UHF. Scan Delay and Channel Lockout. Measures 2 3/4 x 6 1/4 x 1". Includes rubber ducky antenna. Order crystal certificate for each channel. Made in Japan.

TEST ANY SCANNER

Test any scanner purchased from **Communications Electronics**™ for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

CIRCLE 51 ON FREE INFORMATION CARD

Fanon Slimline 6-HLU

List price \$169.95/CE price \$109.00

Low cost 6-channel, 4-band scanner!

The Fanon Slimline 6-HLU gives you six channels of crystal controlled excitement. Unique Automatic Peak Tuning Circuit adjusts the receiver front end for maximum sensitivity across the entire UHF band. Individual channel lockout switches. Frequency range 30-50, 146-175 and 450-512 MHz. Size 2 3/4 x 6 1/4 x 1". Includes rubber ducky antenna. Order crystal certificates for each channel. Made in Japan.

Fanon Slimline 6-HL

List price \$149.95/CE price \$99.00

6-Channel performance at 4-channel cost!

Frequency range: 30-50, 146-175 MHz.

If you don't need the UHF band, get this model and save money. Same high performance and features as the model HLU without the UHF band. Order crystal certificates for each channel. Made in Japan.

OTHER SCANNERS & ACCESSORIES

NEW! Regency† D810 Scanner	\$319.00
NEW! Regency† D300 Scanner	\$219.00
NEW! Regency† D100 Scanner	\$169.00
NEW! Regency† H604 Scanner	\$129.00
Regency† M400 Scanner	\$259.00
Regency† M100 Scanner	\$199.00
Regency† R1040 Scanner	\$149.00
SCMA-6 Fanon Mobile Adapter/Battery Charger	\$49.00
CHB-6 Fanon AC Adapter/Battery Charger	\$15.00
CAT-6 Fanon carrying case with belt clip	\$15.00
AUC-3 Fanon auto lighter adapter/Battery Charger	\$15.00
PSK-6 Base Power Supply/Bracket for SCMA-6	\$20.00
SP50 Bearcat AC Adapter	\$9.00
SP51 Bearcat Battery Charger	\$9.00
SP58 Bearcat 4-6 ThinScan™ carrying case	\$12.00
MA506 Regency carrying case for H604	\$15.00
FB-E Frequency Directory for Eastern U.S.A.	\$12.00
FB-W Frequency Directory for Western U.S.A.	\$12.00
FFD Federal Frequency Directory for U.S.A.	\$12.00
TSG "Top Secret" Registry of U.S. Government Freq.	\$10.00
B-4 1.2 V AAA Ni-Cad batteries (set of four)	\$9.00
A-135cc Crystal certificate	\$3.00
Add \$3.00 shipping for all accessories ordered at the same time.	

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have six base and mobile antennas specifically designed for receiving all bands. Order #A60 is a magnet mount mobile antenna. Order #A61 is a gutter clip mobile antenna. Order #A62 is a trunk-lip mobile antenna. Order #A63 is a 3/4 inch hole mount. Order #A64 is a 3/8 inch snap-in mount, and #A70 is an all band base station antenna. All antennas are \$35.00 and \$3.00 for UPS shipping in the continental United States.

BUY WITH CONFIDENCE

To get the fastest delivery from **CE** of any scanner, send or phone your order directly to our Scanner Distribution Center. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance. Minimum order \$35.00.

Mail orders to: **Communications Electronics**, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$7.00 per scanner or phone product for U.P.S. ground shipping and handling, or \$14.00 for faster U.P.S. air shipping to some locations. If you have a Visa or Master Card, you may call anytime and place a credit card order. Order toll free in the U.S.A. Dial 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. Dealer inquiries invited. Order without obligation today!

Scanner Distribution Center™ and CE logos are trademarks of Communications Electronics.

† Bearcat is a federally registered trademark of Electra Company, a Division of Masco Corporation of Indiana.

‡ Regency is a federally registered trademark of Regency Electronics Inc.

Copyright ©1981 Communications Electronics™



COMMUNICATIONS ELECTRONICS™

854 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

We're first with the best.™

Radio- Electronics

THE MAGAZINE FOR NEW
IDEAS IN ELECTRONICS

Electronics publishers since 1908

DECEMBER 1981 Vol. 52 No. 12

SPECIAL FEATURES

- 47 **VIDEOTEX FOR TV: HOW IT WORKS**
Part 2. A TV information service being considered for approval by the FCC. Here's a look at the competing systems, what they offer and how they work. **Richard Larratt**
- 55 **RADIO MOSCOW IS WINNING THE dB WAR**
Is Russia ahead of the United States in communications technology? Here's a look at that mystery and some possible explanations. **Stanley Leinwoll**
- 58 **ETCH YOUR OWN PC BOARDS**
Even the most complicated boards are easy to make using this technique. **Neil R. Davis**

BUILD THIS

- 43 **HI-FI DECODER FOR DISCS**
CBS's new noise-reduction system for phonograph records. Build yours today and take advantage of the new, noiseless CX-encoded discs. **Joel Cohen**
- 51 **4 SIMPLE TOYS**
Easy to build and yet entertaining to a youngster. They all make delightful presents for the holiday season. **Dan and Diane Talbot**
- 61 **HI-FI MINI-SPEAKER**
Small, efficient, and great sounding. Based on a patented principle that works. **George Pappanikolaou**
- 72 **LIMIK**
Harmless insect-like gadget that is a sure-fire attention grabber. **Merritt Keppel**

TECHNOLOGY

- 4 **VIDEO ELECTRONICS**
Tomorrow's news and products in this quickly changing industry. **David Lachenbruch**
- 14 **SATELLITE/TELETEXT NEWS**
The latest happenings in communications technology. **Gary H. Arlen**
- 76 **HOBBY CORNER**
The best reader-submitted "idiot box" circuit plus other tid-bits. **Earl "Doc" Savage, K4SDS**
- 92 **NEW IDEAS**
Speaker-overload protector.

COMPUTERS

- 88 **COMPUTER CORNER**
What software is and what it does. **Les Spindle**

VIDEO

- 69 **COLOR ALIGNMENT**
Step-by-step procedures show you how to align the color-video stages in your TV. **Jack Darr**
- 94 **SERVICE CLINIC**
Some hints to help you revive a dead set. **Jack Darr**
- 95 **SERVICE QUESTIONS**
R-E's Service Editor solves technicians problems. **Jack Darr**

AUDIO

- 64 **HOW TO CHOOSE THE BEST CASSETTE TAPE**
Simple tests using a VTVM help you to determine which cassette tape provides the best performance with your deck. **Len Feldman**

EQUIPMENT REPORTS

- 23 **Keithley 870 Digital Thermometer**
- 23 **Radio Shack TRS-80 Model III Microcomputer**
- 24 **Grove Enterprises FTR-2 Scanner Filter**
- 26 **Beckman Tech 350 and Tech 360 DMM's**
- 41 **Heath IM-2410 Frequency Counter**

DEPARTMENTS

- | | |
|----------------------------------|-------------------|
| 10 Advertising and Sales Offices | 12 Letters |
| 142 Advertising Index | 108 Market Center |
| 103 Books | 102 New Lit |
| 112 Computer Market Center | 96 New Products |
| 10 Editorial | 6 What's News |
| 143 Free Information Card | |

SEASON'S GREETINGS

*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
our best wishes for
a happy new year*

ON THE COVER

CBS's new CX noise-reduction system for records is the latest happening in hi-fi—and the system works! Build our CX decoder and take advantage of the new CX records. They're available now and more are being introduced every day. Turn to page 43.

Radio-Electronics, (ISSN 0033-7862) Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Second-Class Postage Paid at New York, N.Y. and additional mailing offices. One-year subscription rate: U.S.A. and U.S. possessions, \$13.00, Canada, \$16.00. Other countries, \$20.50 (cash orders only, payable in U.S.A. currency.) Single copies \$1.25. © 1981 by Gernsback Publications, Inc. All Rights reserved. Printed in U.S.A.

Subscription Service: Mail all subscription orders, changes, correspondence and Postmaster Notices of undelivered copies (Form 3579) to Radio-Electronics Subscription Service, Box 2520, Boulder, CO 80322.

A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.

As a service to readers, Radio-Electronics publishes available plans or information relating to newsworthy products, techniques and scientific and technological developments. Because of possible variances in the quality and condition of materials and workmanship used by readers, Radio-Electronics disclaims any responsibility for the safe and proper functioning of reader-built projects based upon or from plans or information published in this magazine.

VIDEO ELECTRONICS

DAVID LACHENBRUCH
CONTRIBUTING EDITOR



STEREO TV

A preview of what may be in store for the U.S. occurred in West Germany Sept. 4, when television broadcasting with dual-channel sound began simultaneously with the opening of the huge Internationale Funkausstellung (audio-video) show in Berlin. The new sound system uses two discrete (non-multiplexed) channels, for left-plus-right and $2 \times$ right signals, with 60-dB separation for either stereo, or two completely separate sound channels, and no measurable crosstalk. Currently, dual-channel sound is broadcast on only one of the three West German networks but its coverage extends to about 65% of the population.

That didn't prevent every German TV-manufacturer from introducing a wide variety of TV models with dual-sound capability. Of 21 new color sets introduced by Blaupunkt (see left photo), for example, 19 featured dual sound. Some manufacturers' deluxe TV's had audio amplifiers with outputs of up to 20 watts-per-channel. Designs varied widely from "compact" dual-speaker models no larger than standard monophonic sets, to furniture-styled sets with detachable speakers, and component video systems with floor-standing speakers and high-wattage outputs.

Although "converters" for existing mono sets aren't available as such, most manufacturers offer stereo TV-sound tuners designed for use with a mono TV and a home stereo system, that accomplish the same purpose. Philips added small-screen portable "boom boxes" in both black-and-white and color, with speakers surrounding a central screen. Most of the dual-channel TV's also have earphone jacks that work independently of the speakers. With a dual-language broadcast, one viewer can listen to German sound through the loudspeaker, while another hears the English translation through headphones; who hears which channel depends on the adjustment of the balance control.

Philips, Grundig, and other manufacturers using the European-designed *Video 2000* VCR-format, already have added stereo video-recorders to their lines. The German stereo system differs from the multiplex technique used in Japan—as a matter of fact, it's being used as a weapon against Japanese imports. Patents on the system are held jointly by the seven West German TV manufacturers, who have decided not to license imports before 1983. However, Sony stereo TV's are appearing on the German market; that is because Sony owns a plant in West Germany and is also one of the seven patent-holders.

SELF-PROGRAMMING VCR

Programmable VCRs are great, but even technically proficient viewers have a problem setting them up. So how about an attachment that simply "reads" the program listing in newspaper or magazine? That's exactly what ITT's German consumer electronics subsidiary, Standard Elektrik Lorenz was showing at the Berlin fair. The program-reader is a small box, with a set of LCD displays, that has an attached small light-pen. Each program listing in a magazine or newspaper is followed by a series of vertical lines resembling the product codes used for supermarket checkout. If the viewer comes across a program he wishes to tape, he merely runs the light pen across the code and the VCR is set up (see right photo). To check the setting, the attachment has readouts showing date, channel, and program starting and ending time. The ending time can be extended manually in case the program runs longer than expected. ITT says it has applied for U.S. patents, and that both Philips and Grundig also hope to manufacture the program reader.

NEW "ILLUMINATOR"™^{*}

MOBILE CB ANTENNA

Hats-off to another engineering/styling breakthrough from Armstrong . . . the brand new "ILLUMINATOR"™ CB antenna.

This lighted antenna looks classy . . . like a luxury car coach lamp. It hooks up to your car's tail light in seconds with a nifty connector. It has a 5000 hour lamp, plus all the engineering extras from Armstrong like a quiet shunt-fed coil . . . copper plated stainless steel whip . . . UNI-AXIS™ balljoint tilts, 45° in all directions . . . water-tight quick disconnect load with protective rain cap . . . triple-chrome-plated solid machined brass fittings . . . a 24 month Warranty on even consumer installations.

Your new "ILLUMINATOR"™ antenna will refuse to light-up if it isn't properly grounded. Proper grounding is essential for optimum antenna operation, so the "ILLUMINATOR"™ offers a visual check on your installation.

CLEAR-FLEX™ coax . . . Another styling first from Armstrong . . . eighteen feet of **CLEAR-FLEX™** 58-AU type coax cable is furnished with every "ILLUMINATOR"™ antenna. It looks as highly engineered as it really is with a stranded inner conductor and in-line coax connectors for simple, solderless installation.

Just call our toll free number 800-435-1855 for the name of your local dealer and see the new "ILLUMINATOR"™ today.



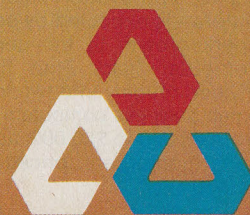
DEALER
INQUIRIES
INVITED

*Patent pending

NEW MODEL TAK 10L
(Trunk lip mount only)

All-American
Armstrong

A Division of Monitor Crystal Service, Inc.
P.O. Box 237 • Route 24 West • Watseka, IL 60970
Toll Free (Outside Illinois) 800-435-1855 • Illinois 815-432-5296



CIRCLE 60 ON FREE INFORMATION CARD

WHAT'S NEWS

Video bank service tested in California

Selected customers of the First Interstate Bank of California are participating in a Day and Night Video Banking Service, a six-month electronic home-banking pilot program of the bank.

Customers can use the system to transfer funds between any number of their accounts. They can also pay bills, authorizing the bank to transfer funds from their accounts direct to those of merchants registered with the service. The customer can also receive immediate information on balances of check-accounts, savings accounts, or certificates of deposit. The bank also posts general information, including certificate-of-deposit interest rates and locations of its automated teller machines.

Customers use Radio Shack TRS-80 Videotex terminals and videotex-equipped TRS-80 Color Computers, on free loan from the bank. According to a bank spokesman, the equipment was selected for its off-the-shelf availability and nationwide maintenance network, and because it is equipment that an average bank customer would consider buying.

Individual account security is maintained with one-way password coding and individual-customer ID numbers. To increase security, repeated unsuccessful attempts to access an account result in an automatic lockout that requires manual resetting to put the account back into action.

IBM's entry in market boosts small computers

IBM's recent announcement of a personal desktop computer—and thereby placing its seal of approval on small computers—is expected by some to spark growth in the personal-computer field. That field is divided roughly into two levels—small business computers priced from \$5,000 to \$20,000, and personal computers, priced under \$10,000.

IBM now has a 26% share in the small business computer market, and a 2.6% share of the worldwide personal computer market; but it may be some time before it can increase its portion of the small personal computer market significantly. According to market research analyst Karen Horowitz, of Venture Development Corp., Wellesly, MA, "IBM will have to strengthen its positions in distribution channels and applications software before Radio Shack and Apple have anything to worry about."

IBM will sell the little computers through its own direct sales force, IBM's retail stores, and independent retailers. The direct sales force is geared to

selling to large corporations, and IBM will have to set up a network of dealers. That will take time. Both Apple and Radio Shack have elaborate channels of distribution that have taken several years to establish.

A shortage of software may be another weakness, says Karen Horowitz. Applications programs will have to be made available for the small business, educational institutions, and the home, as well as for large companies.

RCA VideoDiscs to use CX noise reduction

The new RCA "CED" stereo videodisc system, scheduled for introduction in 1982, will use the CX noise-reduction system,

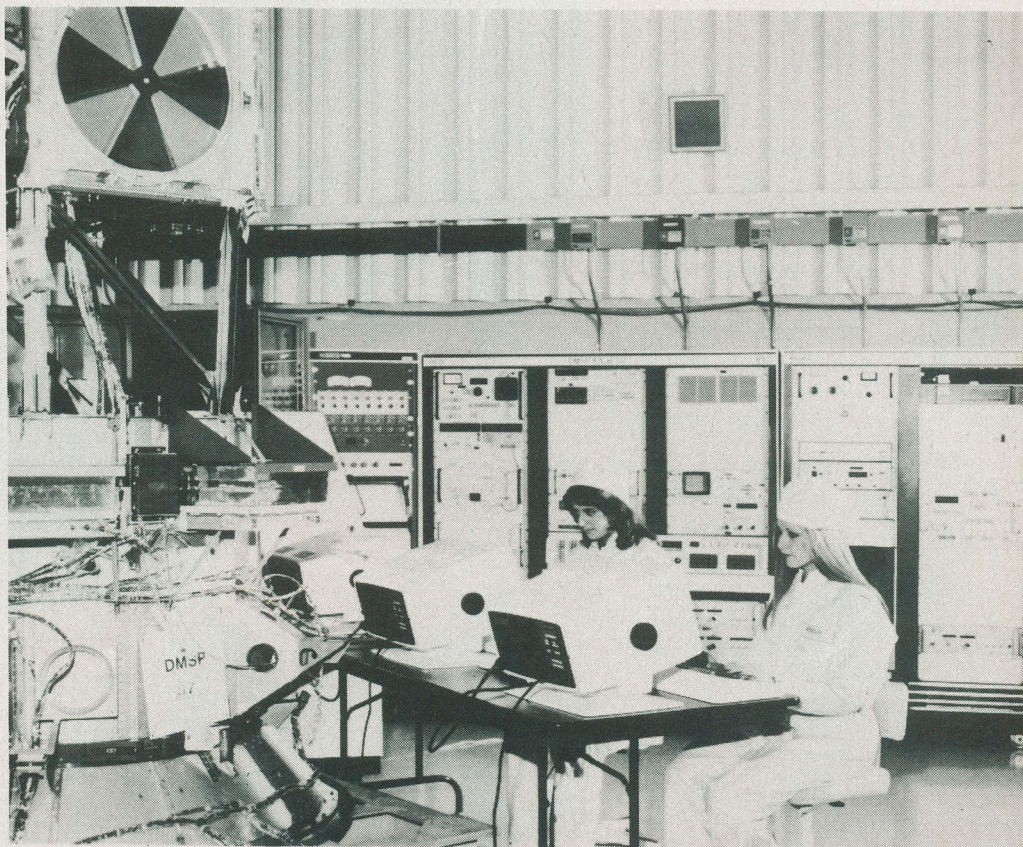
under license from CBS. The stereo discs will be fully compatible with the monophonic "CED" player models introduced in 1981. Earlier in the year MGM/CBS Home Video announced that it will use the CX process in its stereo "CED" discs.

CX is a compatible audio system that eliminates surface noise and increases the dynamic range of audio recordings by 20 dB, resulting in a range of nearly 85 dB—comparable to the sound of a live concert.

For more on CX, see page 63 of the November 1981 issue of Radio-Electronics and page 43 in this issue.

Performance specifications for videodisc applications of CX will *continued on page 8*

WEATHER SATELLITE



RCA ENGINEERS JANISE BALDO AND PAT SAITTA MAKE ELECTRICAL TESTS on a Block 5D-a spacecraft (left). The spacecraft will become part of the Air Force's Defense Meteorological Satellite Program, which provides weather information for the U.S. military and civilian users. The site is the RCA Astro-Electronics laboratory in Princeton, NJ, where RCA recently added a wide range of data-processing equipment to its testing facilities.

YOU ALREADY OWN HALF OF THE WORLD'S MOST ADVANCED HOME ENTERTAINMENT SYSTEM.

You're already halfway to Magnavision® right now. Because all you have to do is plug it into your present color TV set.

Magnavision is a turntable. A *video* turntable as well as an audio one. It plays discs that show pictures on your TV. With stereo sound capability.

And what pictures. Magnavision delivers a picture that's clearer and crisper than video tape TV, even TV itself. And the Magnavision picture lasts, because the discs are impervious to wear.

See the buttons on the front of the Magnavision unit? They give you total control over what you watch and how you watch it. Consider the possibilities: Reverse. Slow motion. Individual frame-by-frame indexing. More. And you can exercise control from anywhere in the room, since Magnavision Model 8005 (shown here) gives you a full-feature remote control.

AMAZING: PICTURES WITH STEREO SOUND.

Magnavision even gives you high-fidelity stereo sound.

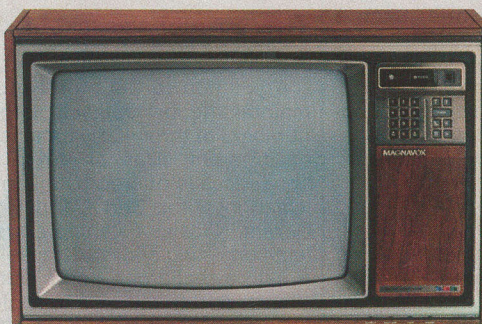
Just run it through your present stereo system and choose from one of the many stereo videodiscs (concerts, musicals, shows). You can't get stereo with video tape, and stereo TV is years away. Imagine, now you can see Liza Minnelli* for example, as well as hear her in stereo concert!

All of this wonderwork comes from Magnavision's laser-optical scanner. It is a beam of light that works like an audio player's "needle." But Magnavision's laser-optical scanner has none of the archaic limitations of a needle.

Magnavision is full of ideas. It can be a learning machine as well as an entertain-

ment source. Many of the discs are interactive. You can carry on a dialogue with them. *How To Watch Pro Football*†, *The First National Kidisc*†—games, puzzles, questions and answers for your children, *The Master Cooking Course*†, and *Jazzercise*† are just four examples.

You can put as many different kinds of programs on your television screen with Magnavision as you can imagine. Choose from over 120 videodisc albums now. They range from classic movies to new releases. From sports instruction to art gallery tours. From cartoons to concerts. And new programs are continually being developed exclusively for videodiscs.



So put your half of the world's most advanced home entertainment system together with Magnavision soon. *For the name of your nearest dealer, please call toll-free 800-447-4700 (in Illinois, 800-322-4400).*

© 1981 N.A.P. CONSUMER ELECTRONICS CORP.
A NORTH AMERICAN PHILIPS COMPANY
*Liza In Concert©, Pioneer Artists™ †Optical Programming Associates©

MAGNAVISION



MAGNAVOX

The brightest ideas in the world
are here today.

CIRCLE 84 ON FREE INFORMATION CARD

WHAT'S NEWS

continued from page 6

be finalized at the time of product introduction, an RCA spokesman noted.

Digital TV standard for worldwide use?

The European Broadcast Union submitted to the September, 1981, meeting of the International Radio Consultative Committee (CCIR) a proposed set of digital-television standards for studio equipment. The Union hopes that it will be adopted throughout the world. Such a standard is needed because more and more television equipment is going digital. Both picture quality and economy of operation in international transmissions would be enhanced if all units were compatible.

The EBU believes that a world standard would mean less expensive equipment, would benefit international program exchange, and would lead to improvement in the technical quality of programs transmitted from one country to another country with a different system.

In the EBU system, the separate components would be coded, with the luminance component sampled at 13.5 MHz and the two color-difference signals at 6.75 MHz. Thus the system would be called "13.5:6.75:6.75."

The Third World Conference of Broadcasting Unions suggested a worldwide standard at

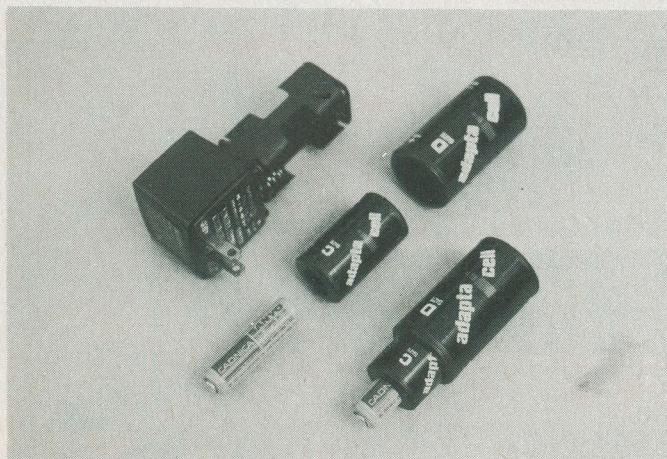
its 1980 meeting in Tokyo. In this country, the Society of Moving Picture and Television Engineers has been studying the problem, and the EBU has been coordinating its work with that of the SMPTE. The Organization de la Television Ibero-americana also supports the proposed EBU system. That is considered especially important, because the OTI area contains both the 525- and the 625-line systems.

New adapter sleeves make AA cell universal

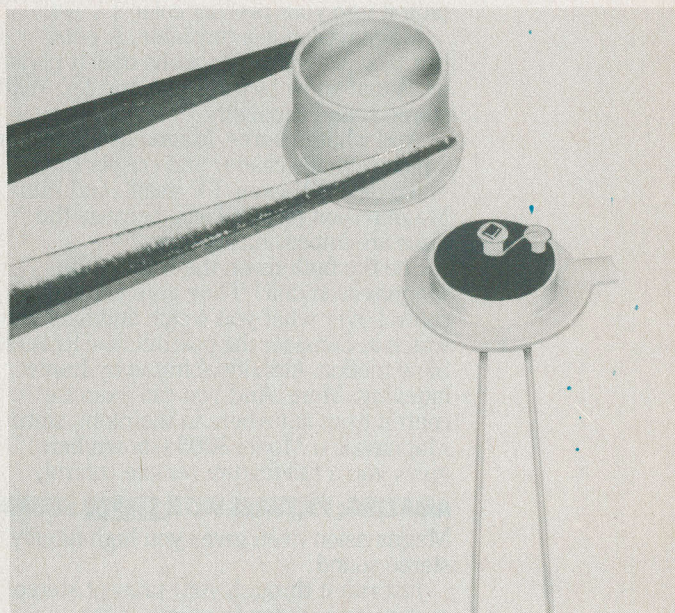
A solution to the problem of maintaining or replacing large numbers of throwaway batteries of different sizes on toys or appliances is offered by a Long Island inventor. Bert Trattner of Coram, NY, has patented a system consisting of a rechargeable A cell, a recharger, and plastic sleeves that fit the cells to applications that require C or D cells.

The system is said to offer advantages both in economy and convenience. Some high-current motorized toys, says Trattner, will run longer on a single charge of his battery than the complete life of a throwaway D-cell. And whichever device goes dead, the rechargeable cell can replace it, whether AA, C, or D.

Further information may be obtained from Burton Products Corp., 416 Clubhouse Court, Coram, NY 11727.



THE "UNIVERSAL AA CELL" SYSTEM.



THE RCA C30979E PHOTODIODE.

New photodiode detector for optical communications

RCA Electron Optics and Devices has announced a new indium-gallium-arsenide photodiode, developmental type C30979E, for reception between 900 and 1650 nanometers. The new device provides high-speed responsivity and is optimized for detection of 1300 and 1550 nanometer sources. It is intended for use in advanced prototype fiber-optic systems.

The new device is fitted with a removable cap that permits optimum coupling of the fiber to the photosensitive surface of the detector. The expected price will be \$450.00 each, with delivery 30 days after receipt of order. Those desiring further information may obtain it by writing to RCA, Box 3200, Somerville, NJ 08876.

Electronic newspaper to fill special gaps

The "electronic newspaper," (teletext, viewdata, and systems of the future) will be confined during the next several years to less than 10% of present newspaper readers—more than 90% will continue with their present

"paper" versions, in spite of the number of systems proposed or already being put into use. That is the opinion of International Resource Development, Inc. (IRD)—a Norwalk, Connecticut, consulting and publishing firm—which has published a 186-page report, selling at \$985, on the subject.

One of the chief potentials for the electronic news services, IRD believes, lies in providing information in greater depth than the regular newspaper. Thus a subscriber with a videotex terminal or home computer could key in a request for more detailed information on an event than is provided by his regular newspaper. Another possibility is that the terminal user could be provided with a wide range of news on a subject previously selected for special coverage.

The 10% will consist in large part of those who already have viewdata equipment or home computers. However, IRD expects that during the 1980's the market will expand to about \$500 million annually, divided about equally between consumer-oriented and business-oriented services.

Why use their flexible discs:

Athana, BASF, Control Data, Dysan, IBM, Maxell, Nashua, Scotch, Shugart, Syncom, 3M, Verbatim or Wabash

when you could be using

MEMOREX

for as low as \$1.94 each?

Find the flexible disc you're now using on our cross reference list... then write down the equivalent Memorex part number you should be ordering.

Product Family	Product Description	Memorex Part Number (3201-1)	CE quant. 100 price per disc (\$)	Athana	BASF	Dysan	IBM	Maxell	Nashua	Scotch 3M	Shugart	Syncom	Verbatim	Wabash	Control Data
Flexible Disc 1s Single-Headed Drives Single-Density Media	IBM Compatible (128 B/S, 26 Sectors)	3060	1.99	473071	53428	800506	2305830	FD1-128	FD-1	740-0	S/A 100	15002	FD34-9000	F111111X	421602
	IBM Compatible (128 B/S, 26 Sectors) w/ W.P.N.	3062	2.04	—	—	—	—	—	—	740-0	—	—	FD34-9000	—	—
	IBM Compatible (128 B/S, 26 Sectors) w/ W.P.N. & Hub Ring	3064	2.39	—	—	—	—	—	—	—	—	—	FD34-9000	—	—
	IBM Compatible (128 B/S, 26 Sectors) REVERSIBLE	1729	3.19	473072	54431	—	—	—	FD-2	740/2-0	—	15150	FD34-9000	F116111X	—
	IBM System 6 Compatible	3066	2.04	473077	54561	800509	1669959	—	—	740-0 056	—	15003	FD60-9000	F112111X	—
	IBM Compatible (256 B/S, 15 Sectors)	3109	1.99	473073	—	800584	2305845	—	—	740-3600	—	15005	FD36-9000	F112111X	—
	IBM Compatible (1512 B/S, 8 Sectors)	3110	1.99	473074	—	800585	1669954	—	—	—	—	15004	FD60-9000	F113111X	—
	Shugart Compatible, 32 Hard Sector	3015	1.99	470901	53802	101/1	—	FH1-32	FD-132	740-32	S/A-101	15025	FD32-9000	—	421322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3087	2.49	—	54491	—	—	—	—	740-32PH	—	—	—	F37A411X	—
	CPT 8000 Compatible	3045	2.69	—	—	—	—	—	—	—	—	15226	—	—	—
Flexible Disc 1d Single-Headed Drives Double-Density Media	IBM Compatible (128 B/S, 26 Sectors)	3090	2.69	474071	54568	3740/1D	—	FD1-128/M2100	FD-10	741-0	—	—	FD34-9000	F131111X	423002
	Soft Sector (128 B/S, 26 Sectors) REVERSIBLE	3093	3.69	—	—	—	—	—	—	—	—	—	—	—	—
	Shugart Compatible, 32 Hard Sector	3091	2.69	470801	54596	101/1D	—	FH1-32D	—	741-32	S/A-103	15075	FD32-9000	F33A411X	423322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3088	3.09	—	—	—	—	—	—	—	—	—	—	—	—
Flexible Disc 2s Double-Headed Drives Single-Density Media	Soft Sector (128 B/S, 26 Sectors)	3113	3.09	—	54428	800814	1766870	—	—	—	S/A-150	15153	FD10-4026	F121111X	—
	Soft Sector (256 B/S, 15 Sectors)	3106	3.09	473477	54226	800815	2736700	FD2-256D	—	742-0	—	15154	FD10-4015	F122111X	424612
Flexible Disc 2d Double-Headed Drives Double-Density Media	Soft Sector (Unformatted)	3102	3.09	473485	—	0Y150	—	FD2-XDM	FD-2D	743-0	—	15103	DD34-4001	—	425002
	Soft Sector (128 B/S, 26 Sectors)	3115	3.09	—	—	—	—	—	—	—	S/A-150	—	—	—	—
	Soft Sector (256 B/S, 26 Sectors)	3103	3.09	473471	54325	800817	1766872	FD2-256D	—	743-0/256	—	15101	DD34-4026	F144111X	425602
	Soft Sector (512 B/S, 15 Sectors)	3114	3.09	473472	54478	800818	1669044	—	—	743-0/512	—	15100	DD34-4015	F145111X	425612
	Soft Sector (1024 B/S, 8 Sectors)	3104	3.09	473473	54485	800819	1669045	—	—	743-0/1024	—	15102	DD34-4008	F147111X	425622
	32 Hard Sector	3105	3.09	470851	—	101/2D	—	FH2-32D	—	743-32	S/A-151	15125	DD32-4000	F34A411X	425322
	Burroughs B-80 Compatible, 32 Hard Sector	3092	3.09	—	—	—	—	—	—	—	—	—	—	—	—
	Soft Sector (1024 B/S, 8 Sectors) w/ Hub Ring	3116	3.49	—	—	—	—	—	—	—	—	—	—	—	—
	Shugart Compatible, 32 Hard Sector	3161	3.39	—	—	—	—	—	—	—	—	—	DD32-4000	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Flexible Disc FD Memorex 851 or Equiv. Drive Compatible	FD V1 (Vinyl Jacket)	30712003	2.69	470651	—	FDIV	—	—	FD-165	511-0	—	15026	FD65-1000	F61A111X	—
Mini Flexible Disc 1s 5 1/4" Single-Headed Drives Single-Density Media	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	—	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	441002
	10 Hard Sector	3403	1.94	475010	54257	107/1	—	MD 110	MD 110	744-10	S/A-107	15325	MD525-10	M41A211X	441102
	16 Hard Sector	3405	1.94	475016	54258	105/1	—	MD 116	MD 116	744-16	S/A-105	15326	MD525-16	M51A211X	441162
	Soft Sector (Unformatted) w/Hub Ring	3431	2.14	—	—	—	—	—	—	—	—	—	MD525-01	—	—
	10 Hard Sector, w/Hub Ring	3433	2.14	—	—	—	—	—	—	—	—	—	MD525-10	—	—
	16 Hard Sector, w/Hub Ring	3435	2.14	—	—	—	—	—	—	—	—	—	MD525-16	—	—
Mini Flexible Disc 1d 5 1/4" Single-Headed Drives Double-Density Media	Soft Sector (Unformatted)	3417	2.14	—	54646	104/1D	—	—	—	—	—	—	MD525-01	—	—
	10 Hard Sector	3418	2.14	—	54649	107/1D	—	—	—	—	—	—	MD525-10	—	—
	16 Hard Sector	3419	2.14	—	54652	105/1D	—	—	—	—	—	—	MD525-16	—	—
	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	—	—	—	—	—	—	—	—	—	MD525-01	—	—
	10 Hard Sector w/Hub Ring	3483	2.34	—	—	—	—	—	—	—	—	—	MD525-10	—	—
	16 Hard Sector w/Hub Ring	3485	2.34	—	—	—	—	—	—	—	—	—	MD525-16	—	—
Mini Flexible Disc 2d 5 1/4" Double-Headed Drives Double Density Media	Soft Sector (Unformatted)	3421	2.59	—	54624	104/2D	—	—	—	—	S/A-154	—	MD550-01	—	—
	10 Hard Sector	3423	2.59	—	54627	107/2D	—	—	—	—	S/A-157	—	MD550-10	—	—
	16 Hard Sector	3425	2.59	—	54630	105/2D	—	—	—	—	S/A-155	—	MD550-16	—	—
	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	—	—	—	—	—	—	—	—	—	MD550-01	—	—
	10 Hard Sector w/Hub Ring	3493	2.79	—	—	—	—	—	—	—	—	—	MD550-10	—	—
	16 Hard Sector w/Hub Ring	3495	2.79	—	—	—	—	—	—	—	—	—	MD550-16	—	—

Memorex Flexible Discs...The Ultimate in Memory Excellence

Quality

Memorex means quality products that you can depend on. Quality control at Memorex means starting with the best materials available. Continual surveillance throughout the entire manufacturing process. The benefit of Memorex's years of experience in magnetic media production, resulting, for instance, in proprietary coating formulations. The most sophisticated testing procedures you'll find anywhere in the business.

100 Percent Error Free

Each and every Memorex Flexible Disc is certified to be 100 percent error free. Each track of each flexible disc is tested, individually, to Memorex's stringent standards of excellence. They test signal amplitude, resolution, low-pass modulation, overwrite, missing pulse error and extra pulse error. They are torque-tested, and competitively tested on drives available from almost every major drive manufacturer in the industry including drives that Memorex manufactures. Rigid quality audits are built into every step of the manufacturing process and stringent testing result in a standard of excellence that assures you, our customer, of a quality product designed for increased data reliability and consistent top performance.

Customer-Oriented Packaging

Memorex's commitment to excellence does not stop with a quality product. They are proud of their flexible discs and they package them with pride. Both their packaging and their labeling have been designed with your ease of identification and use in mind. The desk-top box containing ten discs is convenient for filing and storage. Both box labels and jacket labels provide full information on compatibility, density, sectoring, and record length. Envelopes with multi-language care and handling instructions and color-coded removable labels are included. A write-protect feature is available to provide data security.

Full One Year Warranty — Your Assurance of Quality

Memorex Flexible Discs will be replaced by Memorex if they are found to be defective in materials or workmanship within one year of the date of purchase. Other than replacement, Memorex will not be responsible for any damages or losses (including consequential damages) caused by the use of Memorex Flexible Discs.

Quantity Discounts Available

Memorex Flexible Discs are packed 10 discs to a carton and 10 cartons to a case. Please order only in increments of 100 units for quantity 100 pricing. We are also willing to accommodate your smaller orders. Quantities less than 100 units are available in increments of 10 units at a 10% surcharge. Quantity discounts are also available. Order 500 or more discs at the same time and deduct 1%; 1,000 or more saves you 2%; 2,000 or more saves you 3%; 5,000 or more saves you 4%; 10,000 or more saves you 5%; 25,000 or more saves you 6%; 50,000 or more saves you 7% and 100,000 or more discs earns you an 8% discount off our super low quantity 100 price. Almost all Memorex Flexible Discs are immediately available from CE. Our warehouse facilities are equipped to help us get you the quality product you need, when you need it. If you need further assistance to find the flexible disc that's right for you, call the Memorex compatibility hotline. Dial 800-538-8080 and ask for the flexible disc hotline extension 0997. In California dial 800-672-3525 extension 0997.

Buy with Confidence

To get the fastest delivery from CE of your Memorex Flexible Discs, send or phone your order directly to our Computer Products Division. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. All sales are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Minimum order \$50.00. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

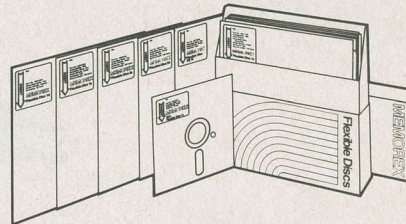
Mail orders to Communications Electronics, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$8.00 per case or partial-case of 100 8-inch discs or \$6.00 per case of 100 5 1/4-inch mini-discs for U.P.S. ground shipping and handling in the continental U.S.A. If you have a MasterCard or Visa card, you may call anytime and place a credit card order. Order toll-free in the United States. Call anytime 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. Dealer inquiries invited. All order lines at Communications Electronics are staffed 24 hours.

Copyright ©1981 Communications Electronics™



Order Toll-Free!
(800) 521-4414

In Michigan (313) 994-4444



For Data Reliability—Memorex Flexible Discs

COMMUNICATIONS ELECTRONICS™

Computer Products Division

854 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

CIRCLE 52 ON FREE INFORMATION CARD

EDITORIAL

Another New Year

As you read this, 1981 is about to come to its end. In looking back over the last 12 issues of **Radio-Electronics**, I'm amazed at how much technology has advanced, how much of an effect it has had on our day-to-day lives during this past year, and how much potential it has to affect our lives in the future.

Simply looking at the last 12 covers of **Radio-Electronics** is a journey in and of itself. We covered Golka's recreation of Tesla's original high-voltage experiments; flat-panel television; an affordable satellite-TV antenna; cordless telephones; an inside look at videodisc players, and presented a series covering electronics in your next car. We concluded the series describing how to build the Unicorn 1 robot and started a series describing the proposal for a videotex service that is before the FCC. Construction projects included a pay-TV decoder, an analog reverb for your hi-fi, a \$60 modem that lets you use your computer to call the time-sharing networks, an experimenter's design station, and many more. We showed you how to explore the 100-GHz region and took a historical look at the development of the integrated circuit. We even presented a comprehensive guide on buying your own computer. Indeed, those are just a sampling of the many articles we published.

Whatever 1982 may bring, you can be sure that **Radio-Electronics** will be there to cover it. And we hope that you will share it with us. For starters, our January issue will contain a comprehensive special section covering video entertainment, including projection TV, videogames, videocassette recorders, videodisc, video accessories, and more.

Our editors and staff, the people who create each issue of **Radio-Electronics**, would like to extend to all of our readers and associates Seasons Greetings and a wish for a happy and prosperous New Year.



ART KLEIMAN
Managing Editor

Radio-Electronics®

Hugo Gernsback (1884-1967) founder

M. Harvey Gernsback, editor-in-chief

Larry Steckler, CET, publisher

Arthur Kleiman, managing editor

Josef Bernard, K2HUF, technical editor

Carl Laron, WB2SLR, assistant editor

Jack Darr, CET, service editor

Leonard Feldman

contributing high-fidelity editor

Karl Savon, semiconductor editor

Herb Friedman, communications editor

Gary H. Arlen, contributing editor

David Lachenbruch, contributing editor

Earl "Doc" Savage, K4SDS, hobby editor

Ruby Yee, production manager

Robert A. W. Lowndes, production
associate

Joan Burwick, production assistant

Gabriele Margules, circulation director

Arline R. Fishman,
advertising coordinator

Cover photo by Robert Lewis

Radio-Electronics is indexed in *Applied Science & Technology Index* and *Readers Guide to Periodical Literature*.

Gernsback Publications, Inc.

200 Park Ave. S., New York, NY 10003

President: M. Harvey Gernsback

Vice President: Larry Steckler

Secretary/Treasurer: Carol A. Gernsback

ADVERTISING SALES 212-777-6400

Larry Steckler
Publisher

EAST

Stanley Levitan
Radio-Electronics
200 Park Ave. South
New York, NY 10003
212-777-6400

MIDWEST/Texas/Arkansas/Okla.

Ralph Bergen
The Ralph Bergen Co.
540 Frontage Road—Suite 361-A
Northfield, Illinois 60093
312-446-1444

PACIFIC COAST Mountain States

Marvin Green
Radio-Electronics
413 So. La Brea Ave.
Los Angeles, Ca 90036
213-938-0166-7

SOUTHEAST

Paul McGinnis
Paul McGinnis Company
60 East 42nd Street
New York, N.Y. 10017
212-490-1021



Listen to your planet on a short-wave receiver!

Communications Electronics, the world's largest distributor of radio scanners, is pleased to introduce Panasonic Command Series shortwave receivers. Panasonic lets you listen to what the world has to say. Unlike a scanner, a Command Series radio lets you listen to shortwave broadcasts from countries around the world, as well as the U.S.A. It's the space age shortwave performance you've been waiting for...at a down to earth price you can afford.

All Panasonic shortwave receivers sold by Communications Electronics bring the real live excitement of international radio to your home or office. With your Command Series receiver, you can monitor exciting radio transmissions such as the BBC, Radio Moscow, Ham Radio and our own Armed Forces Radio Network. Thousands of broadcasts in hundreds of different languages are beamed into North America every day. You can actually hear the news *before* it's news. If you do not own a shortwave receiver for yourself, now's the time to buy your new receiver from CE. Choose the receiver that's right for you, then call our toll-free number to place your order with your credit card.

We give you excellent service because CE distributes more scanners and shortwave receivers worldwide than *anyone* else. Our warehouse facilities are equipped to process thousands of orders every week. We also export receivers to over 300 countries and military installations. Almost all items are **in stock for quick shipment**, so if you're a person who needs to know what's *really* happening around you, order today from CE.

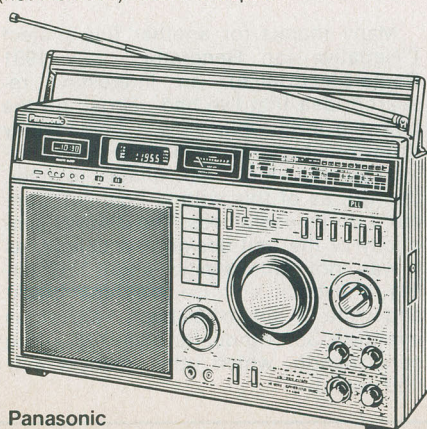
Panasonic RF-6300

Allow 30-120 days for delivery after receipt of order due to the high demand for this product.

List price \$749.95/CE price \$499.00

Bands: LW 150-410 KHz., MW 520-1610 KHz., SW1-5 1.6-30 MHz., FM 87.5-108 MHz.

The new Panasonic RF-6300 Command Series PLL synthesized 8-band portable communications receiver, lets you hear the world. The RF-6300 has features such as microcomputer pre-set tuning and PLL quartz synthesized digital tuner. Microcomputer stores up to 12 different frequencies for push-button recall. FM/MW/LW/SW1-5 reception. Manual tuning knob. Wide/Narrow bandwidth selector. Double superheterodyne system. Fast/Slow manual tuning. Built-in quartz digital alarm clock. 5 inch dynamic PM speaker. 3 antennas. Multi-voltage. Detachable AC cord. Operates on 6 "D" batteries (not included). Made in Japan.



Panasonic
RF-6300



RF-4900

Panasonic RF-4900

List price \$549.95/CE price \$389.00

Bands: MW 525-1610 KHz., SW1-8 1.6-30 MHz.

FM 88-108 MHz.

The Panasonic RF-4900 shortwave receiver features a 5-digit fluorescent display for all 8 SW bands, as well as for AM/FM. AC or battery operation. Full coverage from 1.6 to 30 MHz on SW. Covers SSB and CW. Premix Double Superheterodyne. Fast/slow 2 speed tuning. AFC Switch on FM, narrow/wide selectivity switch for AM and SW. Antenna trimmer. Calibration control. FET RF circuit. Mode switch for AM-CW/SSB. BFO Pitch control. ANL switch for AM. RF gain control. Tuning-Battery meter with meter function switch. Separate bass and treble tone control. Dial light switch. Digital display on/off switch. Separate power switch. Rack type handle. Made in Japan.

Panasonic RF-3100

Allow 30-120 days for delivery after receipt of order due to the high demand for this product.

List price \$369.95/CE price \$269.00

Bands: MW 525-1610 KHz., SW1-29 1.6-30 MHz.

FM 88-108 MHz.

The Panasonic RF-3100 portable 31-Band portable radio has PLL Quartz-Synthesizer tuning that "locks" onto SW stations. Operates on AC or battery. SW frequencies from 1.6 to 30 MHz. are in 29 bands. All-band 5-digit frequency readout. Horizontal design with front mounted controls for shoulder strap operation. Double superheterodyne for clean SW reception. BFO pitch and RF gain controls. Separate bass and treble controls. Wide/Narrow bandwidth selector. Meter for tuning and battery strength. LED operation indicator. Meter light switch. 3 1/2" PM dynamic speaker. Comes with detachable shoulder belt. Battery power (8 "D" batteries not included). Made in Japan.

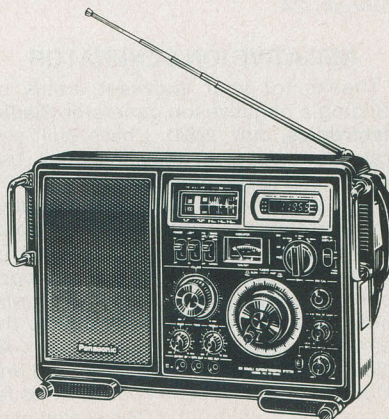
Panasonic RF-2900

List price \$349.95/CE price \$249.00

Bands: MW 525-1610 KHz., SW1-3 3.2-30 MHz.

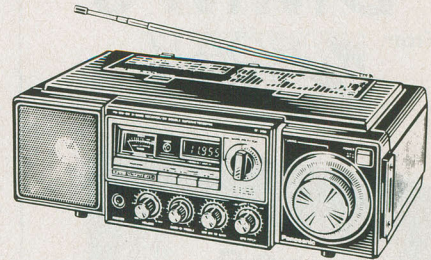
FM 88-108 MHz.

The Panasonic RF-2900 is a portable five-band shortwave radio with digital five digit fluorescent frequency display. Full coverage from 3.2 to 30 MHz. on SW. Covers SSB and CW. Double superheterodyne receiver. Fast/slow 2 speed tuning. AFC switch on FM, narrow/wide selectivity switch for AM and SW. FET RF circuit. BFO switch and pitch control. RF gain control. Tuning battery meter. Separate bass/treble tone control. SW calibration control. Dial light switch. Digital display on/off switch. Separate power switch. Detachable dial hood included. Rack type handle. Includes whip antenna and ferrite core antenna, speaker, earphone, recording output jacks, AC line and detachable adjustable shoulder belt. Made in Japan.



Command Series
RF-2900

Panasonic Command Series



Panasonic
RF-3100

TEST ANY RECEIVER

Test any receiver purchased from Communications Electronics for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping and handling charges).

NATIONAL WARRANTY SERVICE

All Panasonic receivers listed in this ad are backed by a two-year limited warranty on parts and labor. In addition, this warranty is backed by a broad network of Panasonic service centers. For two years after original purchase, Panasonic will repair or replace your receiver if purchased and retained in the U.S.A. Customer must take it to an authorized service center. Warranty does not cover damage from abuse, misuse, or commercial use. Proof of purchase is needed for in-warranty service.

BUY WITH CONFIDENCE

To get the fastest delivery from CE of any receiver send or phone your order directly to our Consumer Products Division. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

Mail orders to: Communications Electronics, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$12.00 per receiver for U.P.S. ground shipping and handling. If you have a Master Card or Visa, you may call anytime and place a credit card order.

Order toll free in the U.S.A. Dial 800-521-4414. Outside the U.S. or in Michigan, dial 313-994-4444.

Dealer inquiries invited. Order your Panasonic Command Series receiver today at no obligation.

CE logos are trademarks of Communications Electronics. † Panasonic is a registered trademark of Panasonic Company, a Division of Matsushita Electric Corporation of America.

Copyright ©1981 Communications Electronics™



**COMMUNICATIONS
ELECTRONICS™**

Consumer Products Division

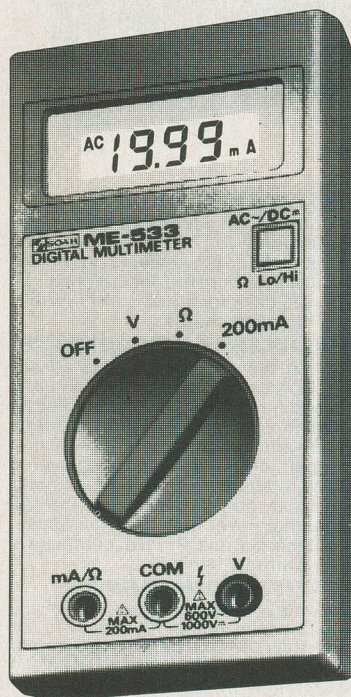
854 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

**We're first
with the best.™**

CIRCLE 53 ON FREE INFORMATION CARD

AFFORDABLE AUTORANGING DMM's

From **SOAR**
corporation



- Full autoranging for AC/DC volts, current and Hi/Lo Pwr. Ω for fast, easy use. Touch button diode test.
- Advanced Micro-Circuit design with reduced parts count for long term reliability.
- Heavy duty ABS plastic case with display window cover for rugged field use.
- Annunciators indicate "AC" mV, mA, Ω , k Ω , plus numerical value for error free readings.
- Auto decimal, polarity and low battery indicator.
- Electronic or fuse overload protection for all functions, just in case...
- Continuity beeper on Models ME-531 and ME-532 for "No-Look" circuit checkout.
- 10 Ampere AC/DC current ranges on ME-531.
- Operates 300 hrs on two "AA" cells.
- Complete with batteries, spare fuse, test leads, full one year ltd. warranty.

MODEL ME-533	\$75.00
ME-532	85.00
ME-531	99.95

Available at selected Distributors or write/phone:

NORTH AMERICAN **SOAR**
corporation
1126 Cornell Avenue, Cherry Hill, NJ 08002
Tel. (609) 488-1060

LETTERS

VERSATILE LIGHT SEQUENCER

I was very pleased to see David Holmes's article on the versatile light sequencer in your June and July 1981 issues of **Radio-Electronics**.

The overall construction was quite simple and straightforward, though one feature—sound-sync-controlled light intensity—could be rewired so that each channel corresponds to a specific range of audio frequencies: channel 1, highs; channel 2, mid-highs; channel 3, mid-lows, channel 4, lows.

To accomplish that, the commons of each opto-isolator (IC8-IC11) should be isolated from each other as shown in Fig. 1 below. Four individual PNP transistors should be used, each with its own filter network for the corresponding frequency.

will help to contain the ozone produced.

Ozone can be quite dangerous. Prolonged exposure, as you may know, can result in serious diseases, such as emphysema.

Second, ordinary sewing needles will not work for long: Early ionizers used them, and they tended to give out in about a year, because the needles become blunt. Surgical stainless steel needles work far better and last much longer. They can be bought at surgical supply houses at a low cost.

Experimenters may be tempted to use other kinds of emitters, such as copper mesh or fuzz. Be careful. You can easily create an ionizer that is spraying off copper, tin, iron, and other molecules, which you might then breathe in. Most manufac-

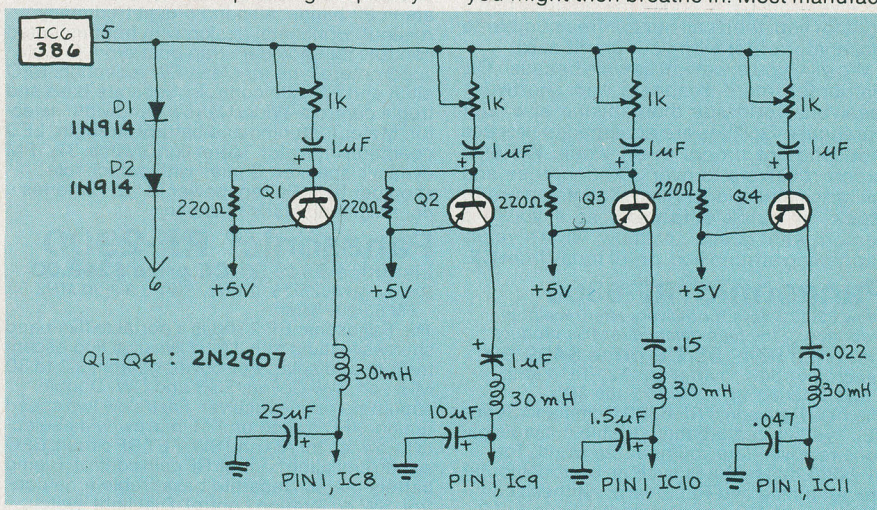


FIG. 1

I hope that suggestion will help make the versatile light sequencer even more versatile for your readers.

JOHN FLEMING,
Turlock, CA

turers now use stainless steel needles. There's a good reason: They seem to be both cheap and safe.

GERALD GROW, PhD,
Tallahassee, FL

NEGATIVE ION GENERATOR

Thanks for your excellent article on building a negative ion generator (**Radio-Electronics**, July 1981). I have built several, to find out what made them tick. Two points need to be emphasized.

First, the major problem with a negative ion generator is ozone production. Ozone, by and large, seems to be produced by internal high-voltage arcs due to sloppy construction. Any sharp solder joints, wire ends, etc., will tend to discharge to the nearest ground and produce ozone. All solder joints need to be quite round and smooth; all connections need to be as far as possible from ground. The sealed case

Many thanks for another fine project ("Negative Ion Generator," July 1981 **Radio-Electronics**), an interesting research idea that I've had pegged on the board a long while now. I immediately threw one together from loose parts, having all but the high-voltage rectifier, though, as of this writing I cannot comment on its usefulness. The devious simplicity of the unit design is a delight, as I was not enthusiastic about extracting a flyback coil from a junk black-and-white TV, which had been my previous intention. Some thoughts occurred during construction, which other readers may find useful.

The ECG513 HV diode stack appears to cost approximately twice that of a GE-513 equivalent, and SK3443 is an exact replacement, also.

Use a regular number-eight cylinder spark plug wire to connect the coil to the diode. The diode ends fit rather nicely, and if you leave access to the wire through a removable panel or otherwise, the ion generator makes an excellent spark plug dynamic tester and cleaning accessory. Be careful, though; I think that about one minute of higher-frequency discharge will pit the electrodes greatly. That is how I tested the oscillator coil before completing the diode assembly.

Even though free air flow around the emitter needle is essential, the needle should still be isolated from accidental touch by a wire cage at a radius greater than one inch. (Take a lesson from cattle prods and laser guns; an arc shock should not be lethal, but under the skin where body resistance may be less than 100 ohms, it could be pretty rough.)

Output voltage depends heavily upon frequency and duty cycle, as well as the coil ratio, and the transistor life expectancy is dependent as such also.

Your greenhouse plants may like this project.

One question: Does any reader know where to obtain a TI SN76489 sound generator controller? That appears to be an extremely useful microprocessor support IC, which I've had the applications notes to for a long time—but I haven't been able to find one.

STAN K. STEPHENSON II,
Tampa, FL

PIRATE BROADCAST STATIONS

I am mystified by Ben Lane's letter (*Radio-Electronics*, August 1981) commenting upon Robert Grove's well-written and informative article on pirate broadcasting stations, which appeared in the May issue. Nowhere in the article did I find the "leftist rhetoric" that Mr. Lane attributes to it; on the contrary, the article seemed to be in the American spirit of freedom for the individual.

Mr. Lane should remember that it is in the Soviet Union, and other similar countries, that people risk arrest and imprisonment for listening to unauthorized broadcasts. That is not the case in the United States—at least, not yet.

There are two different viewpoints from which to evaluate the FCC: the purely technical, and the political. In the technical coordination of frequency allocation and equipment, they have done a very good job on the average. However, whenever a central agency is given authority to regulate the allocation of anything at all—whether it be airwave usage or street repairs—the possibility of abuse of individual rights will be there.

Consider Mr. Lane's remark: "...amateurs have earned their right to a portion of the spectrum." The hidden point of view lies in the word "earned." Mr. Lane does not sound like someone who believes in inalienable rights, but rather in privileges that must be "earned" before being granted by a benevolent central authority. Now that is a leftist point of view.

If Mr. Lane has been in this game for

"almost half a century," he should be aware that it was the amateurs who were using airspace that no one else wanted, and it was they who developed the equipment to open up that airspace—only to have it taken away from them through political considerations involving the FCC. "Earned" indeed!
R.A. (Bob) de FOREST,
McMinnville, OR

UHF-TV RECEPTION

I welcomed your article on improving UHF-TV reception (*Radio-Electronics*, July 1981), but a number of important points were not mentioned. Among them:

1. Never use MIL or JAN RG-59/U or RG-6/U coaxial cable. It is far too lossy and leaky. Use only RG "type" cable having a foam dielectric insulation and a 100% shield made of aluminum foil.

2. Never use cheap coax bought at a discount. Some of the stuff sold in electronics-hobbyist stores is incredibly poor in quality. Spend a few dollars extra for a 100%-sweep-tested coax, such as Belden 9243.

3. Always wrench-tighten connectors for a positive mating and low VSWR.

4. Keep lead-ins as short as possible.

5. Use an antenna having a 75-ohm output whenever possible. That saves the loss of a balun, and eliminates the potential problems thereof.

6. Don't buy an antenna based on meaningless claims of sensitivity based on mileage. Use an accurate field-strength meter to determine the signal intensity, and build the system accordingly.

7. Don't scrimp on quality! A professional-quality UHF antenna system costing \$200 will outperform and outlast any jury-rig system. If you are in a remote area, you can't afford to be "penny-wise and pound foolish."

Antenna systems share a characteristic in common with lawn-sprinkler systems: If you try to "get by" with a mediocre installation, you'll spend more money in the long run than you would if you had put in a top-quality system in the first place.

ERIC G. LEMMON, Chief Engineer,
VideoTel Enterprises,
Lompoc, CA

USER'S GROUP

I am a subscriber and would like to say how much I enjoy your magazine every month. I work in the industry, and find *Radio-Electronics* very supportive.

I have recently become an owner of the "Dyna Micro" 8080 microcomputer described in the May, June, and July 1976 issues. In the May 1976 issue, a user's group was mentioned, and an address given for those interested. Well, I am interested; but the address is no longer valid.

Do you, or any of your readers know if the user's group still exists and, if so, how to get in touch with it. Any help would be greatly appreciated.

MARK KLAFTER,
St. Petersburg, FL

RADAR DETECTORS

Ordinarily, I would have ignored Mark Recob's reply (*Radio-Electronics*, Sep-

continued on page 107

WHY K40 BECAME THE LARGEST SELLING CB ANTENNA IN JUST ONE YEAR!

Because

K40

OFFERS A
MONEY BACK

DOUBLE GUARANTEE

- TRANSMITS
FARTHER
- RECEIVES
CLEARER

**...THAN ANY ANTENNA
IT REPLACES!**



**AN AMERICAN MADE PRODUCT
FROM AN AMERICAN COMPANY.**

Call your local CB Dealer



For a FREE demo!

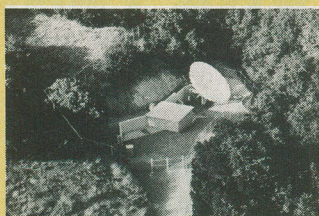
AMERICAN ANTENNA
© Copyright 1979 American Antenna Elgin, Illinois

CIRCLE 63 ON FREE INFORMATION CARD

SATELLITE/TELETEXT NEWS

GARY ARLEN
CONTRIBUTING EDITOR

GOING UP



Most satellite users don't care where the video goes up, as long as it comes down to their antennas. Nonetheless, there's an increasing eagerness to have a close-to-home satellite uplink especially for business video-users. With that in mind, there are more and more satellite uplinks being built. Several have just gone into service in the Washington DC area, and they will be used for business communications as well as for an increasing number of broadcast and cable-TV network programs, including news and entertainment.

Another new uplink is in Salt Lake City, where Bonneville Satellite Corp. has installed a steerable 10-meter dish (see photo) in a canyon that is several miles from local TV studios.

TELETEXT STANDARD

Efforts to create a U.S. technical standard for teletext got a substantial boost recently when Telidon Videotex Systems Inc., the American agents for Canada's teletext technology, filed a proposal with the FCC for a "North American Standard." At the same time, a proposal filed last year by CBS, using France's Antiope system, was modified to fall in line with the Telidon format. Technically, some accommodations were made—but it boils down to a compatible system. The revised Antiope proposal and the new Telidon system will also work with the AT&T videotex system unveiled earlier.

The FCC is still considering all of the proposed teletext technologies, including a system suggested by the United Kingdom Teletext Industry Group, based on British technology. A final decision may be months away.

The Canadian-French proposal spells out an ambitious plan for teletext. It recommends that lines 10 through 18 of the vertical blanking interval be allocated for teletext, although lines 10 through 14 will only be used if it is determined that teletext data would not degrade regular video-program signals. The Telidon suggestion calls for a data rate of 5.727272 megabits-per-second and calls for "terminal independence," meaning that varying levels of resolution will be possible, depending on the sophistication of the home user's receiver.

SHIFTING LAUNCH SCHEDULES

Satellite launches are becoming so numerous that you'd think they would be going off regularly. But the sensitive equipment and timing of each launch often leads to delays—and that's what's happened this fall as several scheduled orbits have been pushed back. It started in early September when SBS II, the digital-data bird of Satellite Business Systems, ran into a problem on the launch pad that shoved its date back into October. That change forced a postponement in the launch date of RCA's Satcom III-R, the new satellite that will deliver all-cable programming; that bird was due for late-October launch, but was pushed back to mid-November. In turn Satcom IV, which was scheduled for mid-December launch, now has a January 1982 date.

AROUND THE SATELLITE CIRCUIT

- Western Union has received FCC permission to begin building its sixth satellite, a \$28-million bird due for launch in late 1983. The 24-transponder Westar VI will be built by Hughes Aircraft and is expected to last 10 years. It will operate in the C-band (6/5 GHz).
- How many people are taking advantage of at-home satellite reception? Current estimates put the audience at 10,000 private-home TVRO's, growing at a rate of 1,000 installations per month. That rate will probably pick up in coming years, according to Jonathan Miller, managing editor of Satellite Week, who foresees about 86,000 home-terminals receiving C-band signals by the end of 1983. That figure could triple during the following two years—but will then probably drop off if Direct Broadcast Satellites, using higher-powered Ku-band, go into operation. Those satellites will permit lower-priced reception equipment.
- Global TV Electronics has undercut its previous lowest-priced satellite reception system. They now offer a \$1695 setup, including their SAT-TEC R2BR 24-channel receiver, 120°K low-noise amplifier, and plans for a 12-foot spherical "screen" antenna, made from 2×4 lumber, for under \$80.

ODYSSEY²

THE EXCITEMENT OF A GAME. THE MIND OF A COMPUTER.

ALL FOR THE PRICE OF AN ORDINARY VIDEO GAME.

Some video games are exciting but short on challenge.

Odyssey², on the other hand, lets you choose your excitement from more than 40 arcade, sports, education and new Master Strategy games that are full of challenges as well as fun, so they keep you coming back for more.

And some video games have an abundance of brainpower, but cost an arm and a leg. Only Odyssey² includes, *at no extra cost*, a full 49-character alphabet and number computer keyboard that gives you access to the mind behind the games. And now there's

The Quest For The Rings.[™] It's the first in our new Master Strategy Series[™] of video games that combine computer technology, your TV set and an advanced game board to transport you to a startlingly realistic alternate world.

Odyssey² Video game fun. Computer keyboard challenge. All for the price of an ordinary video game. See Odyssey² today. It's waiting for you now at your video games or Odyssey² Magnavox dealer.

Odyssey² games include:

- The Quest For The Rings • Speedway*
- Spin-Out* • Crypto-Logic* • Las Vegas
- Blackjack • Armored Encounter • Sub-chase • Football • Bowling • Basketball
- Math-A-Magic • Echo • Computer Intro
- Matchmaker • Logix • Buzzword • Baseball • Computer Golf • Cosmic Conflict • Take The Money And Run • I've Got Your Number
- Invaders From Hyperspace • Thunderball • Showdown in 2001 A.D. • War Of Nerves • Alpine Skiing
- Helicopter Rescue • Out Of This World • Hockey
- Soccer • Dynasty • Volleyball • Electronic Table Soccer
- Pocket Billiards • Pachinko • Blockout • Breakdown
- Casino Slot Machine • UFO • Alien Invaders—Plus.

*Included with original Odyssey² purchase.



The excitement of a game.
The mind of a computer.

Simulated TV picture




© 1981 N.A.P. CONSUMER ELECTRONICS CORP. A NORTH AMERICAN PHILIPS COMPANY

CIRCLE 46 ON FREE INFORMATION CARD

New from NRI! **The first at-home training in** **videocassette recorder repair** **with exclusive videotaped lessons.**

**Learn Video/Audio Servicing...
includes RCA state-of-the-art VCR,
NRI Action Video lessons,
plus full training in
color TV and audio repair.**





hands-on training on the equipment you select.

You can get specialized audio experience as you build your own AM/FM stereo system complete with speakers. Or gain real bench experience with hands-on TV training as you build a 25" (diagonal) fully-computerized, programmable color TV and professional test instruments. Or train with your own RCA videocassette recorder and NRI's exclusive Action Video servicing lessons on videotape.

State-of-the-Art VCR

This modern VCR features high-technology design with electronic pushbutton tuning, remote control, three recording speeds with up to 6-hour capacity, high-speed visual search, built-in clock/timer, memory rewind and audio dubbing capability. Direct drive motors and azimuth recording give outstanding picture reproduction.

It's yours to keep, as part of your training. You'll not only use it to learn operation and servicing techniques, but to play the absorbing NRI Action Video lessons that come as part of your specialized training. In word and picture, you'll learn theory, construction, and service procedures, see them explained in graphic closeups. And you get this unique training only with NRI!

Learn at Home at Your Convenience

No need to quit your job or tie up your evenings at night school. No time away from your family or expensive travel. NRI comes to you. You are a class of one, getting both theory and practical hands-on training backed up by our staff of experienced educators.

NRI the Pros' Choice

More than 67 years and a million and a half students later, NRI is still the first choice in home-study schools. A

national survey of successful TV repairmen shows that more than half have had home-study training, and among them, it's NRI 3 to 1 over any other school.

That's because you can't beat the training and you can't beat the value. Only NRI combines exclusive fast-track training techniques with modern state-of-the-art equipment to give you the skills you need for success quickly and easily. Only NRI offers such complete training with so many timely options for specialized bench experience. Send for our free catalog and get all the facts on these exciting Master Courses in Video/Audio servicing.



Other NRI courses include microcomputers, communications electronics, electronic design.

Free Catalog... No Salesman Will Call

Mail the postage-paid card today for your free copy of our 100-page look into tomorrow. It shows all the equipment you get, describes each lesson in detail. And it tells you about other important career opportunities in Microcomputers and Microprocessors, Digital and Communications Electronics, Electronic Design Technology, and more. Send today and get started on a big new future for yourself. If card has been removed, please write to us.



NRI SCHOOLS
McGraw-Hill Continuing
Education Center
3939 Wisconsin Ave.,
Washington, D.C. 20016

We'll give you tomorrow.

Learn as you work with equipment you keep.

Now, you can learn the hottest, most wanted skill in home entertainment electronics...servicing and repairing videocassette recorders and video disc players. Well over 2 million units have already been sold and the demand is just starting! Already, qualified VCR technicians are in short supply...people are waiting up to a month for VCR repair. Good jobs at good pay are going begging.

And NRI can get you in on the action with convenient and effective at-home training.

Choice of Specialized Training

NRI offers you three Master Courses in Video/Audio Servicing, each complete, each with equipment and training for the specialty you want. Each course thoroughly prepares you for color TV plus audio and video equipment. Then, you take the specialized

The \$149⁹⁵ personal computer.



Introducing the Sinclair ZX81

If you're ever going to buy a personal computer, now is the time to do it.

The new Sinclair ZX81 is the most powerful, yet easy-to-use computer ever offered for anywhere near the price: only \$149.95* completely assembled.

Don't let the price fool you. The ZX81 has just about everything you could ask for in a personal computer.

A breakthrough in personal computers

The ZX81 is a major advance over the original Sinclair ZX80—the world's largest selling personal computer and the first for under \$200.

In fact, the ZX81's new 8K Extended BASIC offers features found only on computers costing two or three times as much.

Just look at what you get:

- Continuous display, including moving graphics
- Multi-dimensional string and numerical arrays

*Plus shipping and handling. Price includes connectors for TV and cassette, AC adaptor, and FREE manual.

- Mathematical and scientific functions accurate to 8 decimal places
- Unique one-touch entry of key words like PRINT, RUN and LIST
- Automatic syntax error detection and easy editing
- Randomize function useful for both games and serious applications
- Built-in interface for ZX Printer
- 1K of memory expandable to 16K

The ZX81 is also very convenient to use. It hooks up to any television set to produce a clear 32-column by 24-line display. And you can use a regular cassette recorder to store and recall programs by name.

If you already own a ZX80

The 8K Extended BASIC chip used in the ZX81 is available as a plug-in replacement for your ZX80 for only \$39.95, plus shipping and handling—complete with new keyboard overlay and the ZX81 manual.

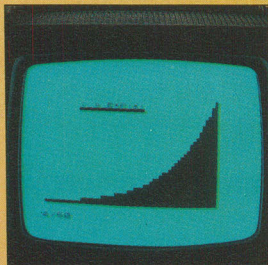
So in just a few minutes, with no special skills or tools required, you can upgrade your ZX80 to have all the powerful features of the ZX81. (You'll have everything except continuous display, but you can still use the PAUSE and SCROLL commands to get moving graphics.)

With the 8K BASIC chip, your ZX80 will also be equipped to use the ZX Printer and Sinclair software.

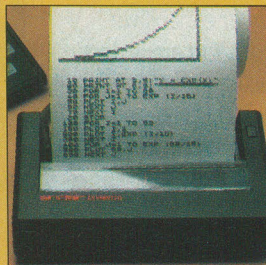
Warranty and Service Program**

The Sinclair ZX81 is covered by a 10-day money-back guarantee and a limited 90-day warranty that includes free parts and labor through our national service-by-mail facilities.

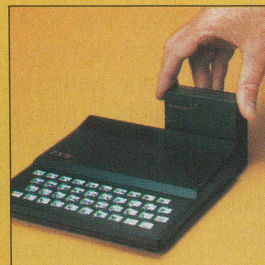
**Does not apply to ZX81 kits.



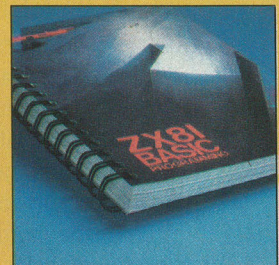
NEW SOFTWARE: Sinclair has published pre-recorded programs on cassettes for your ZX81, or ZX80 with 8K BASIC. We're constantly coming out with new programs, so we'll send you our latest software catalog with your computer.



ZX PRINTER: The Sinclair ZX Printer will work with your ZX81, or ZX80 with 8K BASIC. It will be available in the near future and will cost less than \$100.



16K MEMORY MODULE: Like any powerful, full fledged computer, the ZX81 is expandable. Sinclair's 16K memory module plugs right onto the back of your ZX81 (or ZX80, with or without 8K BASIC). Cost is \$99.95, plus shipping and handling.



ZX81 MANUAL: The ZX81 comes with a comprehensive 164-page programming guide and operating manual designed for both beginners and experienced computer users. A \$10.95 value, it's yours free with the ZX81.

The \$99⁹⁵ personal computer.

Introducing the ZX81 kit

If you really want to save money, and you enjoy building electronic kits, you can order the ZX81 in kit form for the incredible price of just \$99.95* It's the same, full-featured computer, only you put it together yourself. We'll send complete, easy-to-follow instructions on how you can assemble your ZX81 in just a few hours. All you have to supply is the soldering iron.

How to order

Sinclair Research is the world's largest manufacturer of personal computers.

The ZX81 represents the latest technology in microelectronics, and it picks up right where the ZX80 left off. Thousands are selling every week.

We urge you to place your order for the new ZX81 today. The sooner you order, the sooner you can start enjoying your own computer.

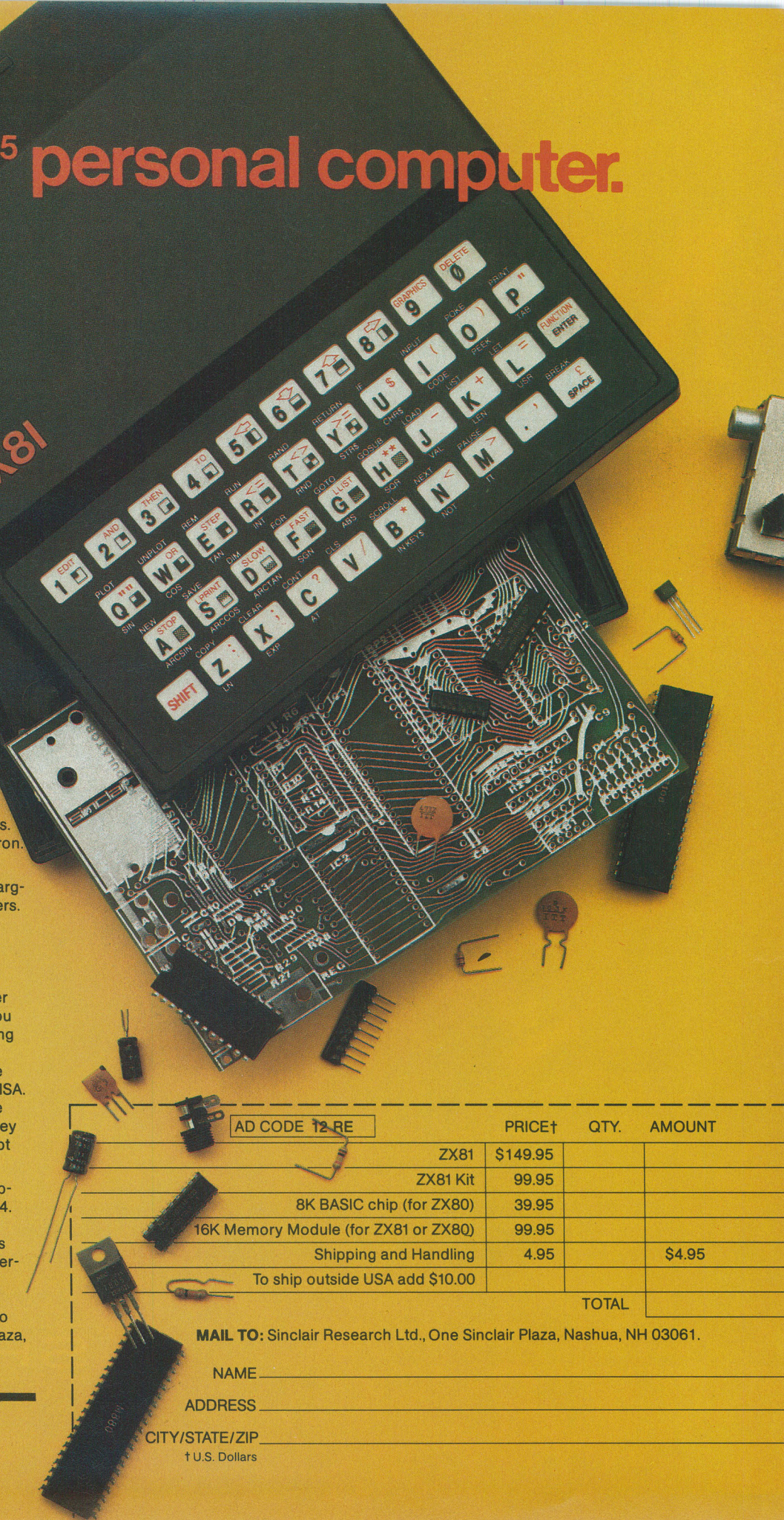
To order, simply call our toll free number, and use your MasterCard or VISA.

To order by mail, please use the coupon. And send your check or money order. We regret that we cannot accept purchase orders or C.O.D.'s.

CALL 800-543-3000. Ask for operator #509. In Ohio call 800-582-1364. In Canada call 513-729-4300. Ask for operator #509. Phones open 24 hours a day, 7 days a week. Have your MasterCard or VISA ready.

These numbers are for orders only. For information, you must write to Sinclair Research Ltd., One Sinclair Plaza, Nashua, NH 03061.

Sinclair



AD CODE 12 RE	PRICE†	QTY.	AMOUNT
ZX81	\$149.95		
ZX81 Kit	99.95		
8K BASIC chip (for ZX80)	39.95		
16K Memory Module (for ZX81 or ZX80)	99.95		
Shipping and Handling	4.95		\$4.95
To ship outside USA add \$10.00			
TOTAL			

MAIL TO: Sinclair Research Ltd., One Sinclair Plaza, Nashua, NH 03061.

NAME _____

ADDRESS _____

CITY/STATE/ZIP _____

† U.S. Dollars

MILLIONS



From the dawn of recorded stereo, millions of audiophiles have turned to Shure phono cartridges to get the most from their stereo systems—and for good reason. We introduced the first moving magnet cartridge, the first truly high fidelity low mass stereo cartridge, and a host of other innovations, right up to today's Hyperelliptical stylus tip, Dynamic Stabilizer, and SIDE-GUARD stylus protection system. From the original M3D, the first high fidelity stereo cartridge (which is still available) to the V15 Type IV, Shure has been the leader in phono cartridge technology.

Our complete phono cartridge line, with over 100 models for all applications, is by far the widest selection offered by any phono cartridge manufacturer in the world. For more than 25 years, Shure has been the performance, technological, and sales leader in high fidelity phono cartridges...and that's why millions of audiophiles around the world have made us their source of sound. See your Shure dealer about upgrading your system with the number one name in phono cartridges.



SHURE

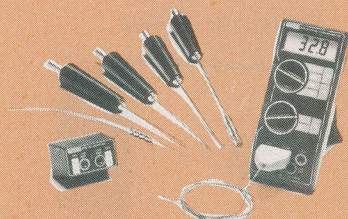
Shure Brothers Inc., 222 Hartrey Avenue, Evanston, IL 60204
In Canada: A. C. Simmonds & Sons Limited

Manufacturer of high fidelity components, microphones, loudspeakers, sound systems and related circuitry.

CIRCLE 50 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

Keithley Model 870 Digital Thermometer



CIRCLE 101 ON FREE INFORMATION CARD

Keithley		870									
OVERALL PRICE											
EASE OF USE											
INSTRUCTION MANUAL											
PRICE/VALUE											
	1	2	3	4	5	6	7	8	9	10	
Poor											Excellent
Fair											
Good											

I RECENTLY GOT HOLD OF A RATHER INTERESTING instrument—one that is totally new to me. It's a *model 870* digital thermometer from Keithley Instruments, Inc. (28775 Aurora Rd., Cleveland, OH 44139), a well-known manufacturer of high-quality test instruments. This unit is styled much like their hand-held DMM's and features a large 3½-digit LCD readout.

The thermometer measures temperatures over four ranges: -40° to 200° Fahrenheit, -40° to 2000° Fahrenheit, -40° to 200° Celsius, and -40° to 1370° Celsius. Those ranges are selected by a four-position switch on the front panel. A two-position switch is used to choose one or the other of the two thermocouple inputs. All thermocouples used are Type K (NiCr/NiAl).

The unit comes with a single thermocouple on wire leads; it has a glass-insulated bead junction. The thermocouple just plugs into either the +TC1 or +TC2 jack, and the -COM jack on the front panel of the instrument. Two other jacks on the front-panel output an ana-

log voltage corresponding to that developed by the thermocouple and are for use with a recorder, or an accurate DMM for high resolution readings (DMM readings can be converted into temperature by using a National Bureau of Standards chart).

Four special-purpose probes are available. They include a probe with a sharp tip for measurements within soft or semi-frozen solids; a surface probe with a special ball-socketed tip that keeps the surface of the sensor flush against what you wish to measure; an air-stream/gas-stream probe, whose exposed junction is protected by a shield (the shield protects the junction from the force of the stream so that the probe can accurately measure the temperature of the air or gas), and a hypodermic probe for biological and medical applications (the tiny junction in that probe has a one-second time constant). All of the probes themselves are stainless steel and have handles and long leads.

If you wish to use two probes (or thermocouples) at a time, a special plug-in adaptor (*model 8701*) is required. One note about the adaptor: If you plan to use it, your probes and thermocouple will require different terminations. The probes and the thermocouple are available with both the standard banana-plug terminations and the miniature plugs required for use with the adaptor.

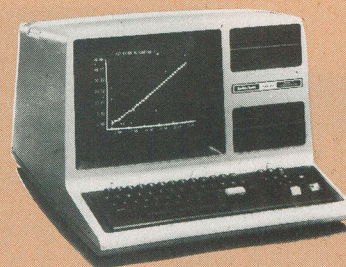
This instrument should be very handy in any application where fast, accurate temperature readings are required. One example of that would be to measure the case temperatures of high-power transistors. To check out the unit, I used it for a somewhat more mundane task. Thermostats on kitchen ovens are not too accurate in any case, but ours was considerably off. It was a simple matter to recalibrate the oven-temperature knob using the digital thermometer, bringing peace at mealtime!

A handy instruction manual that provides operating instructions, describes the use of the probes and adaptors, and has a complete set of disassembly and recalibration instructions comes with the unit. A standard 9-volt battery is required for operation; when the battery is low, a BAT signal appears on the readout. Accuracy is claimed to be 0.25% of reading +1° Celsius.

For any application that requires fast and accurate temperature measurement, this digital thermometer should be just the thing. It's small enough for field work, yet accurate enough for the lab. The suggested retail price for the *model 870* is \$199.00. The specialized probes sell for \$59.00 each, and the *model 8701* adaptor sells for \$35.00.

R-E

Radio Shack TRS-80 Model III Microcomputer



CIRCLE 102 ON FREE INFORMATION CARD

Radio Shack		TRS-80 Model III									
OVERALL PRICE											
EASE OF USE											
INSTRUCTION MANUAL											
PRICE/VALUE											
	1	2	3	4	5	6	7	8	9	10	
Poor											Excellent
Fair											
Good											

MICROCOMPUTERS FOR HOME, BUSINESS, and industry are now available with a bewildering number of features—and from almost as many manufacturers. One company that has done much to make the computer available to the home and small-business user is Radio Shack (1400 One Tandy Center, Fort Worth, TX 76102). The latest addition to its venerable TRS-80 line is the TRS-80 *Model III*. While prices for this computer begin at \$699.00 for the 4K *Level I* version, the unit reviewed here is the business computer featuring 48K of memory and two integral disk drives; it retails for \$2495.00.

The business system comes with two 5¼-inch double-density disk drives. In

addition, an I/O port will accommodate one or two external drives, as well as a cassette recorder. The double-density disks can each store about 175K bytes, for a total system capacity (with the two external drives) of 656K.

A parallel printer-interface and a buffered *Model III* bus-extension are also included. The printer interface lets you connect any of Radio Shack's printers directly.

The 2-MHz Z80-based computer features a full-size typewriter-style keyboard as well as an additional 12-key keypad for numeric-data entry. A REPEAT function is included. The Level II BASIC used in the business system

supports both upper- and lower-case characters.

The video display uses a 12-inch CRT monitor and features scroll-protect, 96 alphanumeric characters, 64 graphics characters, and a further 160 special characters. The monitor can display sixteen 32- or 64-character lines.

An RS-232 serial interface is built into the *Model III* business system (it's optional on the less-expensive version). When used with a modem, it lets the computer communicate with others by telephone.

In operation, we found our *TRS-80 Model III* to be fast and flexible. The RF-interference problem that plagued

earlier *TRS-80* computers, as well as many other units, has been greatly reduced to meet FCC regulations.

If you should run into any problems, I've found the Radio Shack computer service centers to be responsive and helpful. And, as if all of that were not enough, there is a rapidly expanding library of software covering home, business, and even modest industrial applications. To me, it looks as if Radio Shack has another winner on its hands.

R-E

XCELITE TC-100



PROFESSIONAL TOOL CASE

Interchangeable Screwdrivers, Nutdrivers, Other Tools and Handles —

99-1, 1-R, & 4-R Handles (regular, straight and Tee ratchets)
99X2 Square Adaptor
99X5 & X10 Extensions
99-38 & 39 Reamers
99-70 Awl/Scriber
99-125, 250, 312, & 811 Slotted Screw Blades
99-820, 821, & 822 Phillips Screw Blades
Pliers, Wrenches, Cutters
42H Straight Nose Seizer
46C Adjustable Wrench (6")
50CG Midsize Slip Joint Plier (5")
51CG Long Nose Plier (6-1/2")
53CG Utility Plier (7")

54CG & 56CG Diagonal Pliers (4" & 6")
57CG Needle Nose Plier (5-1/2")
59CG Chain Nose Plier (8")
86CG Electronic Snips
103-3 Wire Stripper/Cutter
K-22 Electrician's Knife

Sets & Kits

99-PS-40 Hex Socket Screwdriver Blades & Handle
99-PS-60 Bristol Multiple Spine Screwdriver Blades & Handle
M-60 Mini Drivers
PS-120 Compact Convertible Nutdrivers
XL-75 Offset Ratchet Screwdrivers

600 Combination Screwdriver/Nutdriver Tool

Screwdrivers

Slotted Screws:

R-144 R-3323
R-146 R-3325
R-181 S-388
R-184 S-3161
R-3164 S-5161
R-3166 S-5166
Phillips Screws: SX-101 XST-101
XST-100 XST-102
Hex Socket: P-18 & 19 (.028 & .035)
Nutdrivers HS-6, 8, 10, 11, 12, 14, 16,
18 Hollow Shaft
8M & 10M Magnetic

MODEL TC-100

Larger, more elaborate of the two cases. Contains 41 individual tools, 16 Series 99 interchangeable screwdriver/nutdriver blades and handles, and 5 specialized screwdriver/nutdriver kits, as listed. Case (19-1/2" x 13-1/2" x 6-3/4") covered with attractive, tough, chestnut brown, leather-grain Marvlon. Removable three-panel, hinged pallet and tray outfitted with elastic loop and transparent plastic pocket tool holders. Solid brass locks, latches, and hardware. Padded handle. Partitioned bottom compartment for other tools.

CHRISTMAS SPECIAL

\$349.⁹⁵

Add \$10 shipping.

Xcelite List price \$495.
Offer ends Feb. 28, 1982

THE TEST EQUIPMENT SPECIALISTS



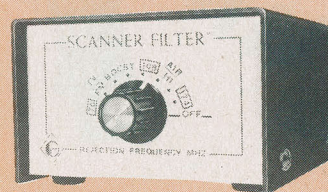
TOLL FREE HOT LINE
800-223-0474



ADVANCE ELECTRONICS

54 West 45 Street, New York, N.Y. 10036 212-687-2224

Grove Enterprises Model FTR-2 Scanner Filter



CIRCLE 103 ON FREE INFORMATION CARD

Grove					FTR-2				
OVERALL PRICE									
EASE OF USE									
INSTRUCTION MANUAL									
PRICE/VALUE									
	1	2	3	4	5	6	7	8	9 10
	Poor		Fair		Good			Excellent	

WITH SEVERAL PROMINENT DOMESTIC and off-shore manufacturers now producing crystal and synthesized scanning-receivers, the number of those units in use is growing at an ever-increasing rate. Thus, it's not surprising that listeners are discovering that those receivers are not immune from interference problems, especially in the larger cities.

The most common problem is image interference caused by signals that are displaced in frequency by twice the unit's IF. Next, and in some locations even more severe, is intermodulation from nearby transmitters. Among the sources of interference most frequently reported are: aircraft being heard on police- and fire-department frequencies; National Weather Service broadcasts, which seem to overpower many scanners, and mobile-telephone base stations, which show up almost anywhere. Since the VHF high-band is the most heavily used band for land mobile services, most of the interference occurs on those frequencies.

In response to those problems, Grove Enterprises has introduced their *model* continued on page 26



LocLoc^{T.M.} *Turn those plain looking belt loops into the latest jewelry fad with America's newest way to tell time.*

It's already a fad in Australia. And the minute you unlock its secret, you'll understand why.

The product is a digital watch in a lock called the LocLoc. The LocLoc hangs from your belt loop and the digital display is upside down to everybody but you.

Want the time, flip up the LocLoc and glance down. There's no watch to wear on your wrist, nothing to lug in your pocket and it makes a great way to keep track of the time while wearing a beautiful new piece of jewelry on your jeans. You can wear the LocLoc on everything from a pair of Calvin Kleins, to formal evening attire or even as a piece of jewelry around your neck.

The LocLoc is a full 5-function digital watch with night light—all housed in a solid brass case. The case is water resistant and comes in three textures: gold-tone, silver-tone, and anodized black.

Just twist the clasp on the lock and it opens. Then slip it over your belt loop. You'll enjoy the freedom of having

nothing on your wrist and the convenience of always having the correct time at a glance.

Want more? The LocLoc comes in a see through vault-like container that fits into a denim drawstring tote bag. In fact, it's packaged as a perfect gift for both men and women—and for any age group.

Try one at no risk. Send your check for **\$29.95** for the silver-tone version or **\$39.95** for the anodized black or gold-tone version, plus \$3.00 postage and handling. (Illinois residents add 6% sales tax.) Credit card buyers may use our toll-free number below.

We'll send you your LocLoc digital watch and clear vault-like container all packaged in its handy gift denim drawstring tote bag. After you receive it, attach it to your belt loop. Feel the freedom of not wearing a watch on your wrist. See how easy it is to glance down at the time and notice what a great accessory and piece of jewelry it makes. If you're not absolutely convinced that LocLoc is perfect for you,

return it for a full refund, including your \$3.00 postage and handling charge. But if you really like it, order more for gifts or for your friends.

Each LocLoc has a one-year limited warranty. Your LocLoc was designed to take plenty of abuse. In fact, the case is actually housed in a solid brass lock. But if service is ever required, our service-by-mail center is as close as your mailbox. JS&A is America's premiere electronics company and a company built upon service.

If you're looking for a really innovative gift—one that you yourself will enjoy—order a LocLoc today.

JS&A PRODUCTS THAT THINK[®]

Dept. RA One JS&A Plaza
Northbrook, Ill. 60062 (312) 564-7000
Call TOLL-FREE 800 228-5000
In Nebraska Call 800 323-6400

© JS&A Group, Inc., 1981

EQUIPMENT REPORTS

continued from page 24

FTR-2 scanner filter. That device is a tunable wave trap designed to notch out interfering signals. Tunable (using a front-panel knob) over a range of approximately 76 to 220 MHz, the filter will attenuate undesired signals by as much as 30 dB while allowing other signals to pass unaffected.

The filter is very easy to use. To hook it up, simply plug your antenna cable into the rear of the unit and plug the interconnecting cable into your

scanner's antenna jack. To use, simply turn the front-panel knob until the offending signal is rejected.

One thing to keep in mind is that the filter will suppress only a single frequency. If there are several interfering signals, all with different fundamental frequencies, the filter will be only partially successful.

How it works

The circuit here is very straightforward. The IN and OUT antenna connectors are interconnected by a 68-pF capacitor. That was done to prevent, or at least diminish, IF feedthrough from shortwave broadcasts. That is a prob-

lem that is often encountered by scanner users, but rarely recognized as such.

A series-tuned LC trap is connected from the antenna connectors to ground; that trap provides the tunable notch. The Q appears to be high, permitting a sharp notch at the frequency selected without attenuating the adjacent frequencies. Naturally, a single-stage tuned circuit such as this can not be tuned precisely to a single frequency, but the unit performs quite well considering its simplicity and low cost.

The front-panel scale is roughly calibrated to show the approximate settings for various sources of interference. While not precise, the scale lets the user turn to about the right spot quickly before fine tuning.

Our test

Connecting the device to a calibrated signal generator and feeding its output to a scanning receiver, we verified that the mid-band rejection is nearly 30 dB as claimed. In addition we found that the insertion loss was only 1 dB at VHF high-band frequencies; the insertion loss did rise slightly at UHF frequencies.

All in all, we found that the *model FTR-2* does perform as the manufacturer claims. While it will not remove all interference problems completely, it can provide considerable relief in crowded metropolitan areas. The *model FTR-2* sells for \$39.95, plus \$2.00 shipping, from Grove Enterprises, Inc., Brasstown, NC 28902. **R-E**

SAVE \$10.43

6100 DIGITAL DESIGN LAB

A Unique design accessory for engineer, student or hobbyist

Rated "BEST VALUE" by instructors

Designer only: \$59.95 Assembled Kit: \$49.95

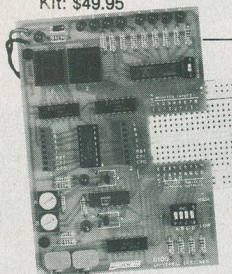
The 6100 **UNIVERSAL DESIGNER** is an indispensable aid to digital IC design. Plugs directly into breadboard elements to provide most often used inputs and outputs at LOW cost.

Save Time and Money!

- Quick and easy breadboarding connections
- Build digital circuits, games, audio circuits and more.
- Timesaving digital design aid
- Re-use as many times as you want
- Easy transition from prototype to wiring diagram
- Ideal for digital training classes
- Great addition to Engineering lab

Features Include:

- 2 Bounceless pushbuttons
- 2 Readouts with BCD Inputs
- 4 Switch outputs
- 8 LED monitors
- 2 Variable Clock Generators
- 2 Decade Counters
- 5-Volt Supply Pins
- Complete Instruction Manual



Shown with QT59S and 2-QT59B breadboards (Not included)

NO RISK GUARANTEE

If the products listed here do not meet your expectations, you may return them within 30 days for a full refund. Your satisfaction is our most important concern. Covers kit products prior to assembly.

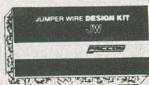
Learn Digital Logic - 26 Experiments

6101 "Experimenting with Digital Circuits"

- All necessary parts included
- Learn gating, binary addition, subtraction and more
- Get hands-on experience by building circuits and performing experiments.
- No logic experience necessary. Good for beginners, intermediates, electronic enthusiasts

\$29.95

New! JW Jumper Wire Design Asst.



Contains 350 wires cut to 14 different lengths, to fit breadboard modules. Pre-cut, pre-formed and individually color-coded. All wire solid tinned, 22 gauge with PVC insulation. Packed in convenient, sectioned box. \$9.95

Assemble Circuits in Minutes—Re-use Components - GSC Quick-Test Breadboards

QT47B	\$ 2.59
QT47S	10.24
QT59B	2.99
QT59S	12.50

21654 Guide to CMOS Basics \$8.95
CMOS devices, their characteristics and design rules. 22 useful experiments demonstrate concepts.

21452 Electronics Thru Troubleshooting 10.95
Practical troubleshooting situations and simple, reproducible examples. Fifteen chapters including question and answer section. Liberally illustrated.

21626 Design of Transistor Circuits 12.95
A self-teaching course on designing transistor circuits. Explores fundamentals of active semiconductors.

21740 Basic Electricity / Electronics 29.95
5 volume set features unique programmed teaching method. Provides basic preparation for electronics, radio and TV repair. No previous knowledge required.

ETRONIX

14803 NE 40th, Dept. ERE12
Redmond, WA 98052 (206) 881-0857



FOR FAST DELIVERY CALL:
TOLL FREE 1-800-426-1044

NAME _____ ADDRESS _____

CITY _____ STATE _____ ZIP _____

☐ VISA ☐ MASTERCARD CARD NO. _____ EXP. _____ SIG. _____

☐ Please send information on additional products available.

SAVE \$10.43 ON COMPLETE DIGITAL DESIGN LAB	6100 Universal Designer	\$59.95
	1 QT59S Breadboard	12.50
	2 QT59B @ 2.99	5.98
	1 Jumper Wire Asst	9.95
NOW ONLY \$77.95	\$88.38	

Please rush the following:

QUAN.		QUAN.	
— Design Lab.	\$77.95	— Jumper Wire Asst.	\$ 9.95
— Designer only	59.95	— 6101 Logic Course	29.95
— Designer kit	49.95	— Book 21654	8.95
— QT47B	2.59	— Book 21542	10.95
— QT47S	10.24	— Book 21626	12.95
— QT59B	2.99	— Book 21740	29.95
— QT59S	12.50		

ORDER TOTAL

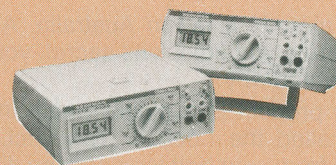
Add 6% for postage

Add \$2.00 handling (under \$25) **2.00**

Add \$1.00 per \$1.00 insurance

TOTAL

Beckman Tech 350 and Tech 360 DMM's



CIRCLE 104 ON FREE INFORMATION CARD

Beckman	Tech 350/360
OVERALL PRICE	
EASE OF USE	
INSTRUCTION MANUAL	
PRICE/VALUE	
	1 2 3 4 5 6 7 8 9 10
	Poor Fair Good Excellent

BECKMAN INSTRUMENTS INC. (2500 Harbor Boulevard, Fullerton, CA 92634), the well-known maker of precision test
continued on page 30

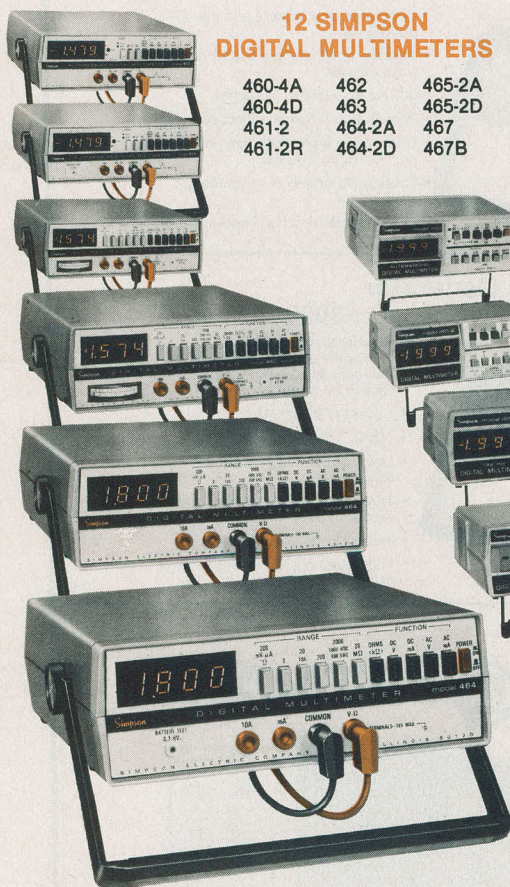
SAFETY IS NO ACCIDENT... at Simpson® It's a Way of Life!

- KNOW YOUR TEST INSTRUMENT!
- KNOW WHAT IT CAN AND CANNOT DO!
- KNOW THE CIRCUIT BEFORE YOU TEST IT!



Nobody but Simpson offers a choice of **29 UL-Listed** analog and digital test instruments, and a selection of matching, UL-Recognized accessories as well. Each one meets the UL-1244 Standard for Safety of Electrical and Electronic Measuring and Testing Equipment. Available at leading electrical and electronic distributors.

Write for free Catalog 5100 and special pamphlet "Straight Talk About UL-1244 Listed Test Instruments"



12 SIMPSON DIGITAL MULTIMETERS

460-4A	462	465-2A
460-4D	463	465-2D
461-2	464-2A	467
461-2R	464-2D	467B

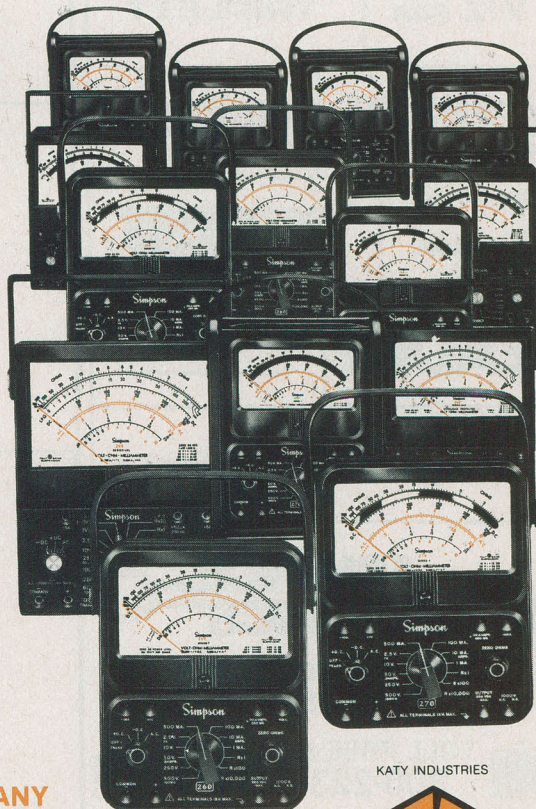
3 SIMPSON AMP-CLAMP® TESTERS

294-2	295-2	296-2
-------	-------	-------



14 SIMPSON 260® VOMs

260-6XL	260-7	260-7PRT
260-6XLM	260-7M	260-7PMRT
260-6XLP	260-7MRT	260-7RT
260-6XLPM	260-7P	270-5
	260-7PM	270-5RT



Simpson®
INSTRUMENTS THAT STAY ACCURATE

SIMPSON ELECTRIC COMPANY

853 Dundee Avenue, Elgin, IL 60120
(312) 697-2260 • Cable SIMELCO • Telex 72-2416
IN CANADA: Bach-Simpson, Ltd., London, Ontario
IN ENGLAND: Bach-Simpson (U.K.) Limited, Wadebridge, Cornwall

KATY INDUSTRIES



ELECTRICAL EQUIPMENT
AND PRODUCTS GROUP

HOLIDAY » SPECIAL «

BK PRECISION

New Portable Digital
Capacitance Meter



MODEL 820
Call For Our Price

HITACHI

KEITHLEY



Non-Linear Systems

FLUKE

HICKOK

VIZ formerly **ROA**

TRIPLETT



PHILIPS

WESTON

Simpson

BK PRECISION

LEADER

DORIC



DATA PRECISION

**ADVANCE
ELECTRONICS**

THE TEST EQUIPMENT
SPECIALISTS



TOLL FREE HOT LINE
800-223-0474

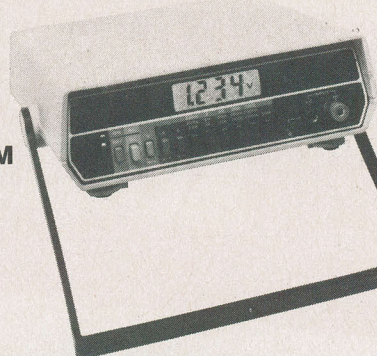


54 WEST 45th STREET, NEW YORK, N.Y. 10036
IN NEW YORK STATE 212-687-2224

KEITHLEY

Model 169
BENCH/PORTABLE DMM

- 3½ Digit liquid crystal display
 - 0.25% basic accuracy
 - 26 Ranges
- \$189.00**



80MHz Counter with Period Function



BK PRECISION

Call For Our Price

MODEL 1820

- 5Hz to 80MHz reading guaranteed—100MHz typical
- Period measurements from 5Hz to 1MHz.
- Period average, auto and manual positions
- One PPM resolution
- Totalizes to 999999 plus overflow
- Elapsed time measurements from .01 to 9999.99 seconds plus overflow
- One-megohm input resistance
- Bright .43" high LED readouts

New Low Distortion Function Generator

BK PRECISION



Call For Our Price

MODEL 3010

- Generates sine, square and triangle waveforms
- Variable amplitude and fixed TTL square-wave outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 0.1Hz to 100kHz
- Variable DC offset for engineering applications
- VCO external input for sweep-frequency tests

New Sweep/Function Generator

BK PRECISION



Call For Our Price

MODEL 3020

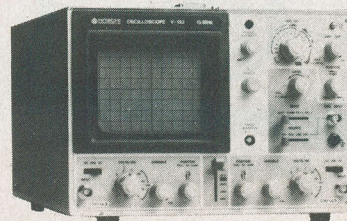
- Four instruments in one package—sweep generator, function generator, pulse generator, tone-burst generator.
- Covers 0.02Hz-2MHz
- 1000: 1 tuning range
- Low-distortion high-accuracy outputs
- Three-step attenuator plus vernier control
- Internal linear and log sweeps
- Tone-burst output is front-panel or externally programmable

V-151B 15 MHz Single Trace
V-152B 15 MHz Dual Trace
V-202 20 MHz Dual Trace
V-301 30 MHz Single Trace
V-302B 30 MHz Dual Trace
V-352 35 MHz Dual Trace
V-550B 50 MHz Dual Trace,
Dual Time Base
V-1050 100 MHz Dual Trace,
Dual Time Base

Call For
Special Intro
Price Offer



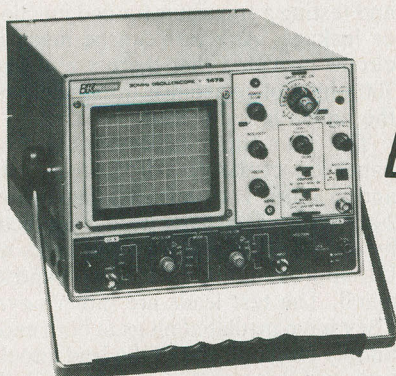
HITACHI



We carry a full line of multimeters, oscilloscopes, frequency counters, audio and RF generators, power supplies and accessories.

Just call our Toll-Free number and one of our experts will answer all your questions about test equipment.

**THESE 1981 B&K OSCILLOSCOPES
ARE IN STOCK AND AVAILABLE
FOR IMMEDIATE DELIVERY**



BK PRECISION

- 1479A Dual-Trace 30 MHz
- 1477 Dual-Trace 15 MHz
- 1432 Dual-Trace 15 MHz Portable
- 1476 Dual-Trace 10 MHz
- 1466 Single-Trace 10 MHz
- 1405 Single-Trace 5 MHz
- 1420 Dual-Trace 15 MHz Portable

**CALL FOR OUR
EARLY BIRD SPECIAL LOW PRICE**

PORTABLE OSCILLOSCOPES

BATTERY OPERATED



Non-Linear Systems

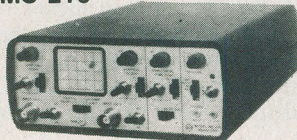
Call For Our Prices

MS-15



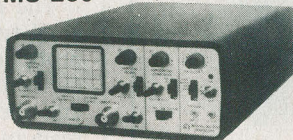
Single Trace 15MHz

MS-215



Dual Trace 15 MHz

MS-230



Dual Trace 30MHz



DIGITAL MULTIMETERS

**Model 8022B:
The Troubleshooter**

\$139

- Six functions
 - dc voltage
 - ac voltage
 - dc current
 - ac current
 - resistance
 - diode test
- 3 1/2-digit resolution
- 0.25% basic dc accuracy
- LCD display
- Overload protection

**Model 8020B:
The Analyst**

\$189

**Model 8024A:
The Investigator**

\$239



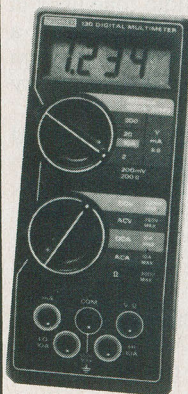
NEW

• Seven functions

- dc voltage
- ac voltage
- dc current
- ac current
- resistance
- diode test
- conductance (1/R)
- 3 1/2-digit resolution
- 0.1% basic dc accuracy
- LCD display
- Overload protection
- Two year parts and labor warranty

• Nine functions

- dc voltage
- ac voltage
- dc current
- ac current
- resistance
- diode test
- conductance (1/R)
- logic level and continuity detect
- temperature (K-type thermocouple)
- Peak hold on voltage and current functions
- Selectable audible indicator for continuity or level detection
- 3 1/2-digit resolution
- 0.1% basic dc accuracy
- LCD display
- Overload protection



\$125.

KEITHLEY MODEL 130 DIGITAL MULTIMETER

	RANGE	ACCURACY
DC VOLTAGE		
200mV, 2V, 20V, 200V, 1000V		.5%
AC VOLTAGE		
200mV, 2V, 20V, 200V, 750V		1%
DC CURRENT		
2mA, 20mA, 200mA, 2000mA, 10A		2%
AC CURRENT		
2mA, 20mA, 200mA, 2000mA, 10A		3%
RESISTANCE		
200Ω, 2kΩ, 20kΩ, 200kΩ, 20MΩ		.5%

**CALL US
FOR OUR
HOLIDAY
SPECIALS!**

EQUIPMENT REPORTS

continued from page 26

equipment, has introduced a pair of bench-model DMM's suitable for lab use, servicing, or any other application where a highly accurate multimeter is required. The *Tech 350* and *Tech 360* DMM's are nearly identical, the major difference being that the *Tech 360* can provide true RMS AC-voltage readings.

Although the instruments are compact (about the size of a cigar box), they can make an amazing variety of measurements. There are 30 ranges in

all, and each function and range is selected by using the large rotary switch on the front panel. The ranges are as follows: AC volts, in 5 ranges, from 200 mV to 1000 volts full-scale; DC volts, in 5 ranges, from 200 mV to 1500 volts full-scale; AC and DC current, in 5 ranges, from 200 μ A to 10 amps full-scale, and resistance, in 7 ranges, from 20 ohms to 20 megohms full-scale.

The remaining range is marked with a diode symbol and is used for testing any semiconductor junction. Unlike the resistance ranges which are "low power" and do not cause a junction to conduct, this range outputs a maximum of 4 mA from a constant-current source.

When the diode test-range is selected, the voltage drop in millivolts across the junction being checked is shown on the 3½-digit LCD display. Among the uses for that range are determining the semiconductor type (silicon or germanium) and testing a transistor for bad junctions or leakage. Any test can be made in-circuit provided that there are at least 300 ohms of resistance in parallel with the junction under test.

The four input jacks on the front panel are COMMON, VOLTS-OHMS, AMPS and 10 AMPS. The AMPS jack has its own 2-amp fuse. The meter itself is protected by a 3-amp fuse. All of the jacks are UL-approved, and there is no exposed metal. The test leads are rather novel: They have insulated plugs at both ends. Simply plug one end of the lead into the test probe you want to use, and the other into the meter. The standard probes have sharp tips and a protective collar.

Small switches in the top right corner of the front panel are used to turn on the unit, turn on the audible continuity-test, and select between RMS AC and RMS AC + DC (*Tech 360* only). The continuity test is used to avoid having to deal with the slow settling-time typical of most LCD displays. To activate it, set the CONTINUITY switch to ON and turn the selector switch to the desired resistance range. When the continuity test is in use, the unit will emit a beep and an Ω symbol will appear on the display any time the resistance is less than twice the maximum of the range selected. The display will show the exact resistance within ½-second. Overrange readings are also indicated by the display.

The *Tech 360* has a special socket for a K-type thermocouple. With that probe in place, the meter can measure temperatures from -20°C to $+1265^{\circ}\text{C}$, and then display them directly on the readout.

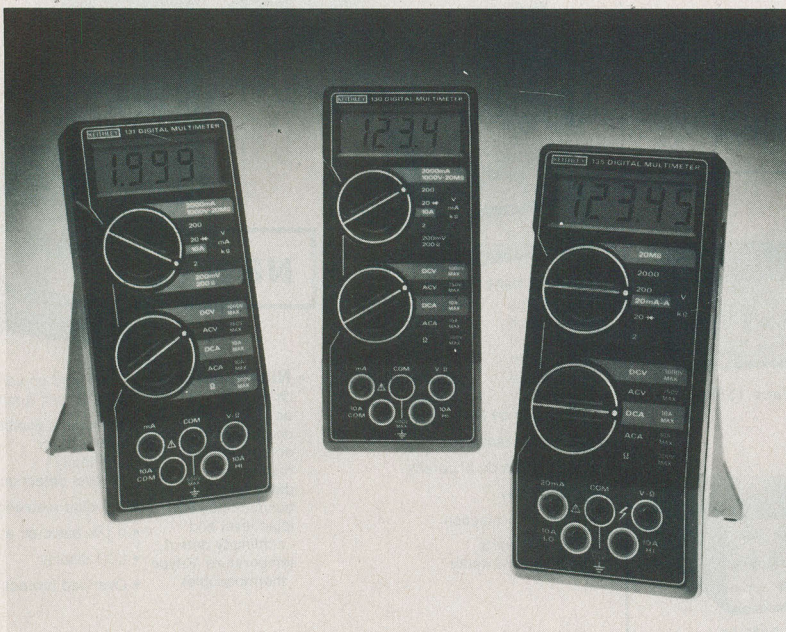
Most of the circuitry is contained in three IC's. The majority of the meter's functions are handled by the LSI "multiprocessor" IC. A smaller IC is used to generate the audio tone used in the continuity test. The third IC is a high-precision divider network used on all the ranges, and helps assure accuracy for many years.

Both meters are battery powered (just the thing for hot-chassis TV sets) and require 6 D-size cells. Battery life is claimed to be 12,000 hours continuous, or up to four years in normal use; only alkaline cells should be used as replacements when required.

In addition to the thermocouple for the *Tech 360*, there are several other accessories available for the two meters. A high-voltage probe extends their range to 50 kilovolts, with an accuracy of $\pm 2\%$. A peak-detecting RF probe ex-

continued on page 41

ADVANCE IS PROUD TO INTRODUCE the KEITHLEY Line of High Quality Digital Multimeters Featuring The New 130 Hand-Held DMM



Rugged DMMs from Keithley — all feature large, bright LCD display, easy-to-use rotary switches, externally accessible battery and fuse, 10A current range, diode test capability, low battery indicator, cushioned components.

Model 131. Similar to Model 130, with increased accuracy **\$134**

Model 130. Our most popular model, the price/performance champ . . . **\$125**

Model 135. First 4½-digit DMM with hand-held convenience . . . **\$235**

MODEL	ACCURACY					SENSITIVITY				
	DCV	DCA	ACV	ACA	Ω	DCV	DCA	ACV	ACA	Ω
130	0.5%	1%	1%	2%	0.5%	100 μ V	1 μ A	100 μ V	1 μ A	100m Ω
131	0.25%	0.75%	1%	2%	0.2%	100 μ V	1 μ A	100 μ V	1 μ A	100m Ω
135	0.05%	0.5%	1%	1.5%	0.2%	100 μ V	10 μ A	100 μ V	1 μ A	100m Ω

Case \$10.00 Shipping \$3.00

THE TEST EQUIPMENT SPECIALISTS

TOLL FREE HOT LINE

800-223-0474

54 WEST 45th STREET, NEW YORK, N.Y. 10036 212-687-2224

ADVANCE

ELECTRONICS

VISA

Introducing incredible tuning accuracy at an incredibly affordable price: The Command Series RF-3100

31-band AM/FM/SW receiver.* No other shortwave receiver brings in PLL quartz synthesized tuning and all-band digital readout for as low a price.† The tuner tracks and "locks" onto your signal, and the 5-digit display shows exactly what frequency you're on.

There are other ways the RF-3100 commands the airways: It can travel the full length of the shortwave band (that's 1.6 to 30 MHz). It eliminates interference when stations overlap by narrowing the broadcast band. It improves reception in strong signal areas with RF Gain Control. And the RF-3100 catches Morse

communications accurately with BFO Pitch Control.

Want to bring in your favorite programs without lifting a finger? Then consider the Panasonic RF-6300 8-band AM/FM/SW receiver (1.6 to 30 MHz) has microcomputerized preset pushbutton tuning, for programming 12 different broadcasts, or the same broadcast 12 days in a row. Automatically. It even has a quartz alarm clock that turns the radio on and off to play your favorite broadcasts.



RF-6300 8-band AM/FM/SW

The Command Series RF-3100 and RF-6300. Two more ways to roam the globe at the speed of sound. Only from Panasonic.

*Shortwave reception will vary with antenna, weather conditions, operator's geographic location and other factors. An outside antenna may be required for maximum shortwave reception.

†Based on a comparison of suggested retail prices.

This Panasonic Command Series™ shortwave receiver brings the state of the art closer to the state of your pocketbook.



With PLL Quartz Synthesized Tuning and Digital Frequency Readout.

Panasonic
just slightly ahead of our time.

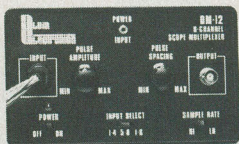
CIRCLE 54 ON FREE INFORMATION CARD

ALBIA Electronics

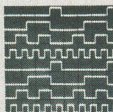
YOUR MAIL-ORDER ELECTRONIC SUPPLY HOUSE!

8 CHANNEL SCOPE MULTIPLEXER, DM-12

Convert your single channel scope into a 4 or 8 channel instrument, just connect the DM-12, 8 channel scope multiplexer to your scope, clip the 8 input probes to the signals you want to view. Simple, easy, fast — can handle logic level TTL signals from DC to 3MHz. Features separate spacing and trace amplitude controls and selectable sampling rate — all to insure easy clear scope display.



Completely Assembled and tested! Ready to use!



VIEW 8 CHANNELS AT ONCE!

\$63⁰⁰

- 8 TTL compatible input channels (1 TTL load per channel) can drive 50 Ohm scope cable.
- Maximum full screen amplitude 1.6 Volts adjustable.
- Trace amplitude and spacing controls.
- 4 or 8 channel selector switch.
- 8 color coded input cable, 24" long with insulated alligator clips.
- External 9 VDC power supply included (Model MMAC-2).
- Size 6.25" x 3.75" x 2".
- BNC Output Cable Accessory (Model PSA-2 add \$14.95).

LOW COST CAPACITANCE METER MODULE, DM-8

Connect this high quality low cost Capacitance Meter Module, DM-8 to your digital Volt Meter and turn it into a Digital Capacitance Meter — the Low Cost Way!



Completely assembled and tested! Ready to use!

\$63⁰⁰

- Push to read range (button) from 1pF to 20,000µF
- Zero calibration control
- In one easy to use, self-contained package.
- Battery powered, with "push to read" battery saver circuit (9V batteries not included).
- Size 6.25" x 3.75" x 2".

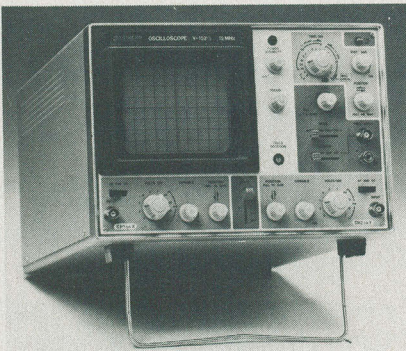
REGULATED TRIPLE POWER SUPPLY, LOW PRICED!, DM-6

A fully assembled and tested power supply that provides a solid, fully wired triple power supply including fixed 5V @ 1 Amp, 5V to 15V @ 0.5 Amp, and -5V to -15V @ 0.5 Amp — all supplies regulated, short proof. Each supply has short indicator LED. Complete and ready for use in a durable (8" x 6" x 3 1/2") metal case.

\$90⁰⁰



HITACHI SCOPE SALE CONTINUED BY POPULAR DEMAND!



- CRT Display area Acceleration potential Intensity modulation
- Vertical deflection Sensitivity and bandwidth Rise time Dynamic range
- Horizontal deflection Sweep mode TV synchronization Internal External

Trigger sensitivity

Trigger slope Sweep time Sweep-time magnifier Max. sweep rate

• Amplitude calibrator Waveform Voltage

• Power requirements

• Dimensions

• Weight

• Ambient operation temperature

1308UB31 (5-inch, round shape)

8x10div (1 div = 9.5mm)
Approx. 2KV
Over 5Vp-p

5mV/div ~ 5V/div ± 5%, DC ~ 15MHz, -3dB
1mV/div ~ 1V/div ± 6%, DC ~ 5MHz Typ. -3dB
(Using x5 amplifier)
24ns
More than 4div at 15MHz

Direct 1M Ohm, approx. 30pF
600Vp-p or 300V (DC + AC peak)
CH1, CH2, DUAL, ADD, DIFF
DC ~ 500 kHz, 5mV/div ~ 5V/div
Phase difference DC ~ 10kHz 3°

Auto. NORM, TV (+), TV (-)
TV sync-separator circuit
Over 1 div (V sync-signal)
Over 1Vp-p (V sync-signal)

Frequency	Internal	External
20Hz ~ 2MHz	0.5div	200mV
2 ~ 15MHz	1.5div	800mV

± 0.2µs/div ~ 0.2s/div ± 5%, 19 calibrated steps
10 times (± 7%)
100ns/div

1kHz ± 10% Typ. Square wave
0.5V ± 3%

100V (120/220/240V) ± 10%
50/60Hz, 40W
Approx. 275(W) x 190(H) x 400(D)mm
Approx. 8.5kg
0 ~ +40°C

MODEL V-152B WITH 2 YEAR MFG. WARRANTY

\$644⁹⁵

WITH FREE DM-12
8 CHANNEL MULTIPLEXER
A COMBINED VALUE
AT LIST OF \$804.95
YOU SAVE \$160.00



YEAR-WARE

NOVEMBER

UP TO OFF OUR

LOW COST HIGH FREQUENCY COUNTER



MODEL NO. DM-7

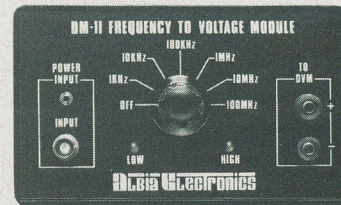
The Albia Model DM-7, 8 Digit High Frequency Counter is easy to use, switch selectable time base input by a single BNC, nothing to build!

- 5 Hz to 550 MHz
- 8 big easy-to-read, 43" high intensity LED display
- Crystal (± 3 ppm @ 25°) controlled 0.1 or 1.0 sec. gate times
- Convenient benchtop size (7"x10"x3") durable attractive case

COMPLETELY ASSEMBLED PRE-CALIBRATED PRE-TESTED

\$135⁰⁰

FREQUENCY METER MODULE "5Hz to 100MHz", DM-11



Measure frequencies from 5Hz to 100MHz on your digital voltmeter with a resolution of 312 digits — easy to use — perfect for field service — lab testing — home hobbyist! Connect the DM-11 to your DVM, set the DVM to the 2VDC range, connect a signal to the DM-11 via a BNC cable (not included) and measure the frequency of any source. Hi Lo Range LED's insure fast accurate readings.

- Frequency Range 5Hz to 100MHz
- Input Impedance 1 MegOhm
- Input Sensitivity: <100Hz <80mV
100Hz ~ 60MHz <30mV
>60MHz <70mV
- Size 6.25" x 3.75" x 2"
- External 9V DC power supply included (Model MMAC-2)
- BNC Input Cable Accessory (Model PSA-2) add \$14.95

\$63⁰⁰

FREE 1981
SALE FLYER
NOW BEING
MAILED! SEND FOR
YOUR COPY TODAY!

If for any reason, whatsoever, you are not completely satisfied with your purchase, return it within 30 days of purchase date for a full refund — it's as simple as that! Shipping & Handling charges not refundable.

ALBIA SATISFACTION WARRANTY:
FOR FAST AND DEPENDABLE DELIVERY SERVICE
CALL TOLL FREE: 1-800-243-6953

IN CT, AK & HI CALL
COLLECT (203) 467-5590

9 A.M. to
5 P.M. E.S.T.

WE ACCEPT MASTER CHARGE, VISA AND AMEX CREDIT CARDS
Connecticut Residents add 7 1/2% Sales Tax • Prices shown in U.S. currency only. Foreign orders add 15%.

ALBIA ELECTRONICS INC
44 KENDALL ST. • P.O. BOX 1833 • NEW HAVEN, CT. 06508

POSTAGE & HANDLING	
ORDERS	ADD
UP TO \$10.00	\$1.95
\$10.01 - \$25.00	3.75
\$25.01 - \$50.00	4.65
\$50.01 - \$100.00	6.45
ORDERS OVER \$100.00 WITHIN UNITED STATES	7.55

FREE ALBIA
DESIGNERS
TEMPLATE
WITH EVERY
ORDER RECEIVED

END HOLIDAY HOUSE CLEARANCE!!

1st THROUGH DECEMBER 31st, 1981 ONLY!!

50% IN SAVINGS

ALREADY LOW FACTORY DIRECT PRICES!



A FAVORITE
OF PROFESSIONAL
ENGINEERS FOR
SETTING UP TEMPORARY
DESIGNS
QUICKLY & EASILY

Design Albia Mate™ Circuit Designers

Pre-wired pre-tested — don't let this price fool you, this is a high quality, high IC capacity, portable self-contained circuit designer

- Control switches and buffered LED logic indicators
- Plug your ICs into solderless breadboards, tie in power and ground, connect your logic switches and LED indicators — FAST, EASY TO USE!
- All interconnections between LEDs, switches and circuits via 22-26 solid wire
- Self-powered, in one compact, good looking and durable carrying case
- Ideal for home experiments, the laboratory and students
- Battery (4 1½ Volt C cells*) or AC powered providing economical bench use or convenient portable use

*Batteries not included

MODEL **\$58.**
DM-5
STOCK NO. 14-0555

NOT A KIT!

DM5-B POWER SUPPLY ADAPTER ACCESSORY **\$18.50**

Design Mate™ 2 Low Cost Function Generator

DM-2 is a 3-waveform function generator, with a short-proof output amplifier providing both variable signal amplitudes and constant output impedance. Completely wired, tested, calibrated and ready to test anything from audio amplifiers or op-amp and educational laboratory designs to complex industrial laboratory projects.

Model DM-2
Stock No. 05-0020

\$49⁹⁷

LIMITED
SUPPLY!



LIMITED
SUPPLY!

**50%
OFF**

\$62⁴⁷

idea of the many ways DM-4 can save you time and effort with digital circuits.

Model DM-4
Stock No. 05-0040

DM-4 Multipurpose Pulse Generator

The Design-Mate 4 may be used as a clock source, delayed pulse generator, synchronous clock source, manual system stepper, pulse stretcher, clock burst generator and in tandem with one or more DM-4's used to gate the output of one or more additional DM-4's. The wide range of controls and functions will give you an

30% OFF!

DM-9 Logic Probe ALBIA'S ECONOMY DIGITAL DM-9 MULTI-LOGIC COMPATIBLE 5-15VDC PROBE

The features are many on this quality Albia test instrument; will detect low rep. rate pulses (up to 1.5 MHz); detects low, high or pulsed logic levels with a minimum detectable pulse width of 300 nsec. Easy-to-interpret 3 LED readout. Built-in over-Voltage and reverse polarity protection.



NOT
A
KIT!

SPECIFICATIONS

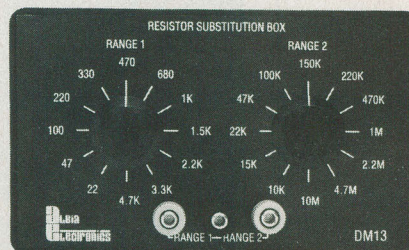
INPUT IMPEDANCE 300,000 Ohms; THRESHOLD Logic 1 thresholds (HI-LED) 70% Vcc Logic 0 thresholds (LO-LED) 30% Vcc; MIN DETECTABLE PULSE WIDTH 300 nanoseconds; MAX. INPUT SIGNAL FREQUENCY 1.5 MHz; PULSE DETECTOR (PULSE LED) High Speed pulse train or single events (+ or - transitions) activate 1/10 sec. and pulse stretcher. MAX. INPUT VOLTAGE ±50V continuous 120VAC for less than 15 seconds. POWER REQUIREMENTS 5 Volt Vcc 30 Ma 15 Volt Vcc 40 Ma 25 Volts max. with power lead reversal protection. OPERATING TEMPERATURE 0 to 50°C PHYSICAL SIZE L x W x D 5.8x1.0x0.7" (147x25.4x17.8 mm) WEIGHT 3 oz.

Model
No. DM-9
Stock No.
17-0009

(85g) POWER LEADS 36" (61 cm) with color coded insulated clips.

\$18⁸⁶ LIMITED
SUPPLY

LOW COST RESISTOR SUBSTITUTION BOX



Model DM-13 Kit

Have fun building this useful kit and save money at the same time. Stop wasting time looking for the right resistor, here's a handy kit that you can easily assemble that will provide everything you'll probably need at your fingertips.

- With complete step-by-step easy to understand assembly instructions
- All resistors are 1/2 Watt, tolerance ±5%
- 5% accuracy
- 24 positions
- 2 ranges

\$39⁰⁰

MODEL
DM-13
STOCK NO.
15-0013

ORDER TODAY!

NOTICE!

SALE PRICES LIMITED TO ACTUAL
INVENTORY AT TIME OF SALE!
NO DEALER ORDERS PLEASE!



SANTA SAYS —
ORDER NOW FOR
HOLIDAY
DELIVERY!

**Albia
Electronics**
YOUR MAIL-ORDER
ELECTRONIC
SUPPLY HOUSE!

CIRCLE 59 ON FREE INFORMATION CARD

DECEMBER 1981

33

You gotta shop around.



**When you do, you'll probably pick CIE.
You can't afford to settle for
less when it comes to something like
electronics training that could
affect your whole life.**

When you shop around for tires, you look for a bargain. After all, if it's the same brand, better price—why not save money? Education's different. There's no such thing as "same brand." No two schools are alike. And, once you've made your choice, the training you get stays with you for the rest of your life.

So, shop around for your training. Not for the bargain. For the best. Thorough, professional training to help give you pride and confidence.

* * *

If you talked to some of our graduates, chances are you'd find a lot of them shopped around for their training. They pretty much knew what was available. And they picked CIE as number one.

Why you should shop around yourself.

We hope you'll shop around. Because, frankly, CIE isn't for everyone.

There are other options for the hobbyist. If you're the ambitious type—with serious career goals in electronics—take a close look at what we've planned for you at CIE.

What you should look for first.

Part of what makes electronics so interesting is it's based on scientific discoveries—on ideas! So the first thing to look for is a program that starts with ideas and builds on them!

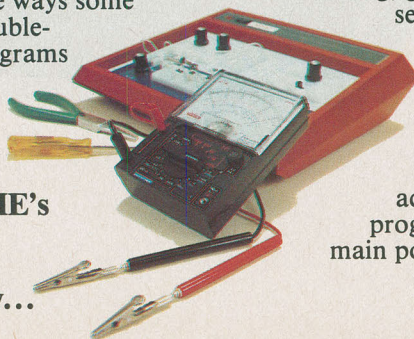
That's what happens with CIE's Auto-Programmed® Lessons. Each lesson takes one or two principles and helps you master them—before you start using them!

How practical is the training?

This is the next big important question. After all, your career will be built on what you can do—and on how well you do it.

Here are ways some of CIE's troubleshooting programs help you get your "hands-on" training...

With CIE's Personal Training Laboratory...

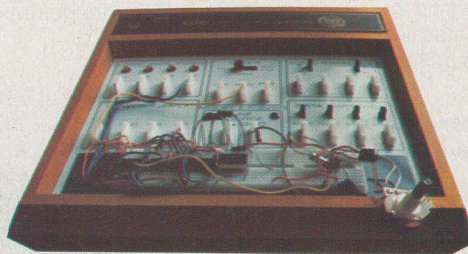


you learn and review the basics—perform dozens of experiments. Plus, you use a 3-in-1 precision Multimeter to learn testing, checking, analyzing!



When you build your own 5 MHz Triggered-Sweep, Solid-State Oscilloscope you take your first real professional step. You use it as a doctor uses an X-ray machine—to "read" waveform patterns... lock them in... study, understand and interpret them!

When you get your Digital Learning Laboratory you'll be into digital theory—essential training today for anyone



who wants to keep pace with the state of the art of electronics in the eighties. With CIE's Digital Lab, you'll be applying in dozens of fascinating ways the theory you've learned. For example, you'll compare analog and digital devices. You'll learn to make binary to decimal conversions and to work with semiconductor devices and circuits. You'll see how digital equipment is vital in today's exciting, growing fields such as security where digital theory provides the brains for space-age alarm and protective devices.

Of course, CIE offers even more advanced training programs, too. But the main point is simply this:

All this training takes effort. But you'll enjoy it. And it's a real plus for a troubleshooting career!

Do you prepare for your FCC License?

Avoid regrets later. Check this out before you enroll in any program.

More than half of CIE's courses prepare you for the government-administered FCC License exam. In continuing surveys, nearly 4 out of 5 CIE graduates who take the exam get their Licenses!

Associate Degree

Now, CIE offers an Associate in Applied Science Degree in Electronics Engineering Technology. In fact, all or most of every CIE Career Course is directly creditable towards the Associate Degree.

Shop around...but send for CIE's free school catalog first!

Mail the card. If it's gone, cut out and mail the coupon. If you prefer to write, mention the name and date of this magazine. We'll send you a copy of CIE's FREE school catalog—plus a complete package of independent home study information! For your convenience, we'll try to have a representative contact you to answer your questions. Mail the card or coupon—or write:

CIE, 1776 East 17th St.,
Cleveland, OH 44114.

CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114

☐ **YES...**I'm shopping around for the right kind of career training in electronics troubleshooting — and CIE sounds well worth looking into. Please send me my FREE CIE school catalog — including details about the Associate Degree program — plus my FREE package of home study information!

Print Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

Age _____ Phone _____ (area code)

Check box for G.I. Bill information:
☐ Veteran ☐ Active Duty

Mail today!

RE-26

HEATH/ZENITH

A GIANT STEP FORWARD

Computer power, printer speed, hard disk storage – all in one system.

The three elements you need for smooth, rapid data handling are together now in one Heath/Zenith system. For word processing, business and financial applications, or custom programming – this is the performance standard evolving in computer technology. It's what you expect from a *strong partner*.

All-In-One Computer

The heart of the system is the Heath/Zenith 89 Computer, a complete, stand-alone unit with professional keyboard, smart video terminal and 5¼-inch disk drive. It's easy to use for people having little or no experience – yet it can also run extended languages like BASIC, COBOL, FORTRAN and Pascal.

The 89 comes with 48K bytes RAM, expandable to 64K. It has two Z80 microprocessors, one for computer functions, one for terminal functions. And three serial I/O ports for interface with printers and modem.

The video display features a 12-inch diagonal, high-resolution CRT that's easy on the eyes. It displays up to 2,000 characters at a time, 24 lines (plus 25th status line) by 80 characters, with full cursor control. Also 33 block graphic characters for charts and graphs.

The heavy-duty keyboard follows standard typewriter format for easy operator training. All terminal functions are programmable from keyboard or I/O ports.

The 5¼-inch floppy diskette stores 100K bytes of information and interfaces on line with the Heath/Zenith 67 Hard Disk System.

Winchester Disk System

The 67 Disk System features one hard disk and one 8-inch, soft-sectored floppy for total on-line storage of 10.782 megabytes (formatted). That's a huge data base.

The floppy is double-sided, double-density and can also operate in single-sided or single-density modes, compatible with standard IBM 3740 format.

The 67 features write-protect switches for both drives to prevent accidental erasure of information. The average access time of the hard disk drive is 70 milliseconds.

High-speed printer

The Heath/Zenith 25 Printer is a heavy-duty, high-speed, dot matrix printer that gives you sharp, clear printouts. It prints over 150 characters per second with whisper-quiet smoothness.

The entire 95-character ASCII set prints in upper case and lower case with descenders, in a 9 x 9 matrix. Also, 33 block graphic characters let you create graphs and charts. All functions and timing are microprocessor-controlled.

It uses standard edge-punched papers and features a convenient cartridge ribbon for easy, no-mess replacement.



ANNOUNCES IN SYSTEM PERFORMANCE

Versatile software and accessories

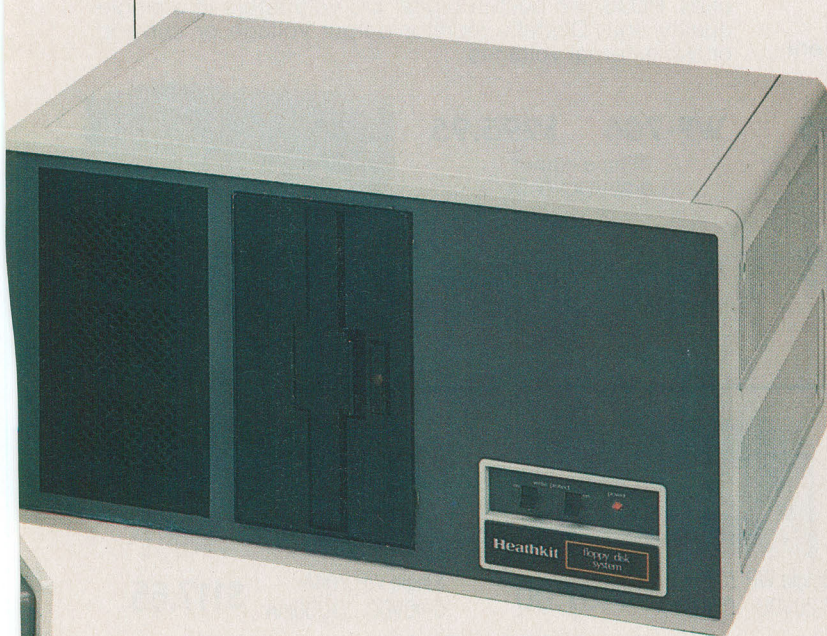
The Heath/Zenith System offers you a choice of operating systems, including popular CP/M.

There are programs for word processing, business applications, and versatile utility functions. And the Heath User's Group offers a library of over 500 low-cost programs for home, work or play.

For your custom programs, Microsoft languages are available in BASIC (compiler and interpreter), FORTRAN and COBOL. Or learn to write and run your own programs with special self-study programming courses for Assembly, BASIC, Pascal or COBOL.

Free demonstration awaits you at your Heathkit Electronic Center

Pick the store nearest you from the list at right. And stop in today for a demonstration of the new Heath/Zenith System. If you can't get to a store, send \$1.00 for the new Zenith Data Systems Catalog of assembled commercial computers and also receive free the latest Heathkit Catalog. Write to Heath Co., Dept. 020-844, Benton Harbor, MI 49022.



Visit Your Heathkit Electronic Center*

where Heath/Zenith Products are displayed, sold and serviced.

PHOENIX, AZ 2727 W. Indian School Rd. 602-279-6247	MISSION, KS 5960 Lamar Ave. 913-362-4486	CLEVELAND, OH 28100 Chagrin Blvd. 216-292-7553
ANAHEIM, CA 330 E. Ball Rd. 714-776-9420	LOUISVILLE, KY 12401 Shelbyville Rd. 502-245-7811	COLUMBUS, OH 2500 Morse Rd. 614-475-7200
CAMPBELL, CA 2350 S. Bascom Ave. 408-377-8920	KENNER, LA 1900 Veterans Memorial Hwy. 504-467-6321	TOLEDO, OH 48 S. Byrne Rd. 419-537-1887
EL CERRITO, CA 6000 Potrero Ave. 415-256-8870	BALTIMORE, MD 1713 E. Joppa Rd. 301-661-4446	WOODLAWN, OH 10133 Springfield Pike 513-771-8850
LA MESA, CA 8363 Center Dr. 714-461-0110	ROCKVILLE, MD 5542 Nicholson Lane 301-881-5420	OKLAHOMA CITY, OK 2727 Northwest Expressway 405-848-7593
LOS ANGELES, CA 2309 S. Flower St. 213-749-0261	PEABODY, MA 242 Andover St. 617-531-9330	FRAZER, PA 630 Lancaster Pike (Rt. 30) 215-647-5555
POMONA, CA 1555 N. Orange Grove Ave. 714-623-3543	WELLESLEY, MA 165 Worcester Ave. 617-237-1510	PHILADELPHIA, PA 6318 Roosevelt Blvd. 215-288-0180
REDWOOD CITY, CA 2001 Middlefield Rd. 415-365-8155	DETROIT, MI 18645 W. Eight Mile Rd. 313-535-6480	PITTSBURGH, PA 3482 Wm. Penn Hwy. 412-824-3564
SACRAMENTO, CA 1860 Fulton Ave. 916-486-1575	E. DETROIT, MI 18149 E. Eight Mile Rd. 313-772-0416	WARWICK, RI 558 Greenwich Ave. 401-738-5150
WOODLAND HILLS, CA 22504 Ventura Blvd. 213-883-0531	HOPKINS, MN 101 Shady Oak Rd. 612-938-6371	DALLAS, TX 2715 Ross Ave. 214-826-4053
DENVER, CO 5940 W. 38th Ave. 303-422-3408	ST. PAUL, MN 1645 White Bear Ave. 612-778-1211	HOUSTON, TX 1704 W. Loop N. 713-869-5263
AVON, CT 395 W. Main St. (Rt. 44) 203-678-0323	BRIDGETON, MO 3794 McKelvey Rd. 314-291-1850	SAN ANTONIO, TX 7111 Blanco Road 512-341-8876
HIALEAH, FL 4705 W. 16th Ave. 305-823-2280	OMAHA, NE 9207 Maple St. 402-391-2071	MIDVALE, UT 58 East 7200 South 801-566-4626
PLANTATION, FL 7173 W. Broward Blvd. 305-791-7300	ASBURY PARK, NJ 1013 State Hwy. 35 201-775-1231	ALEXANDRIA, VA 6201 Richmond Hwy. 703-765-5515
TAMPA, FL 4019 W. Hillsborough Ave. 813-886-2541	FAIR LAWN, NJ 35-07 Broadway (Rt. 4) 201-791-6935	VIRGINIA BEACH, VA 1055 Independence Blvd. 804-460-0997
ATLANTA, GA 5285 Roswell Rd. 404-252-4341	AMHERST, NY 3476 Sheridan Dr. 716-835-3090	SEATTLE, WA 505 8th Ave. N. 206-682-2172
CHICAGO, IL 3462-66 W. Devon Ave. 312-583-3920	JERICHO, L.I. NY 15 Jericho Turnpike 516-334-8181	TUKWILA, WA 15439 53rd Ave. S. 206-246-5358
DOWNERS GROVE, IL 224 Ogden Ave. 312-852-1304	ROCHESTER, NY 937 Jefferson Rd. 716-424-2560	MILWAUKEE, WI 5215 W. Fond du Lac 414-873-8250
INDIANAPOLIS, IN 2112 E. 62nd St. 317-257-4321	N. WHITE PLAINS, NY 7 Reservoir Rd. 914-761-7690	

Prices and specifications subject to change without notice.

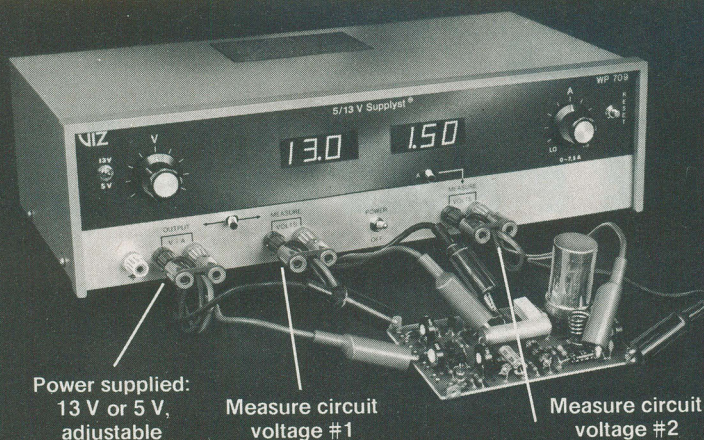
*Units of Veritechnology Electronics Corporation in the U.S.

HEATH/ZENITH

Your strong partner

NEW!

WP-709.
Double-slot
Supplyst™
power supply.



Power supplied:
13 V or 5 V,
adjustable

Measure circuit
voltage #1

Measure circuit
voltage #2

Outputs: 5V or 13V DC,
adjustable $\pm 1\frac{1}{2}V$
Zero to 7.5 amp, each voltage.
Two LED displays,
monitor V or A—
or two DC voltmeters
Adjustable current limiting

Only
\$299.75.

DC power to test logic or mobile equipment. Another VIZ Value

HERE'S REAL PRECISION
Select the precise voltage you want:
5V or 13V, adjustable $\pm 1\frac{1}{2}V$ at each
range. Output is laboratory quality.
Ripple less than 10mV, peak to peak.
Regulation better than 0.1%.

HERE'S REAL POWER
Up to 7.5 amp. at each voltage—

plenty for computer circuits, PA
systems, mobile transmitters, autos,
boats, planes.

HERE'S REAL CONVENIENCE
Front panel controls for instant
voltage adjustment and precise fine
adjustment to within 0.1V. Two 3-digit
LED displays permit continuous

monitoring of both voltage and
current during use. Current limiting
control with instant pushbutton reset.

The WP-709 is like two precision
power supplies for a price less than
you might pay for one— PLUS two
digital DC voltmeters.

VIZ Supplyst™

power supplies with digital displays of voltage and current



WP-705 \$289.95

Single output
0-50VDC. 0-2A.



WP-707 \$374.75

Dual output
Two 0-25VDC. 0-2A.

Fully regulated, adjustable current limiting power
supplies, PLUS two built-in digital DC voltmeters in a single
quality unit. Digitally monitor output voltage or current,
or two external voltages.



WP-706 \$295.95

Single output
0-25VDC. 0-4A.



WP-708 \$424.95

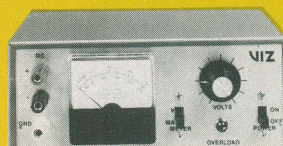
Triple output Two 0-20VDC. 0-2A.
One 5VDC. 0-4A.

VIZ DC power supplies

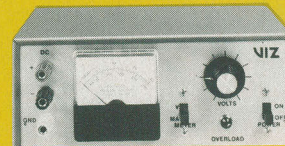
Fully regulated, continuously adjustable voltage
outputs with short circuit protection.
Analog meters and overload indicators.



Dual WP-702A Two 0-20VDC. 0-200mA **\$150.75**



Single WP-703A
0-20VDC. 0-500mA **\$107.00**



Single WP-704A
0-40VDC. 0-250mA **\$117.55**

VIZ RELIABILITY

VIZ is a 50 year-old company. Our instruments are
fully warranted, parts and labor, for a year.
All items tested to NBS standards. We offer service and parts
availability for a minimum of ten years. Over 15 repair depots in U.S.A.

Want full technical details and a demonstration? Call toll-free. **1-800-523-3696**, for the VIZ distributor nearest you

VIZ

Look to VIZ for value, quality, availability.
Over 70 instruments in the line— PLUS full accessories.

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144

CIRCLE 58 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

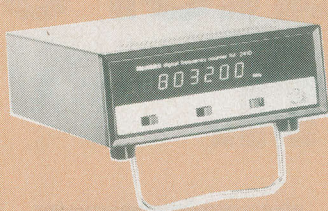
continued from page 30

tends the meters' frequency range to 200 MHz (normally 10 kHz). Two AC-current clamps are also available. One lets you read AC current up to 150 amps without opening up the circuit; the other extends the range up to 1000 amps! A "hold" probe will hold a reading on the display as long as a switch on the probe is held down. A deluxe test-lead kit contains an assortment of probe ends: alligator clips, spade lugs, banana tips, and a spring-loaded hook tip. A storage compartment for extra probes and leads is located under a hinged lid on the top of the case. An optional vinyl carrying-case with a belt loop holds either meter, test leads, and the manual.

We tried one of the meters out on the bench and were very pleased with what we saw. Settling time for the display is very good, and the readings are steady. The claimed accuracy of 1% should make either meter suitable for almost any application. The *Tech 350* has a suggested retail price of \$229.00; suggested price for the *Tech 360* is \$289.00

R-E

Heathkit Model IM-2410 Frequency Counter



CIRCLE 105 ON FREE INFORMATION CARD

Heathkit	IM-2410
OVERALL PRICE	
EASE OF USE	
INSTRUCTION MANUAL	
PRICE/VALUE	
	1 2 3 4 5 6 7 8 9 10
	Poor Fair Good Excellent

A FREQUENCY COUNTER IS ONE OF THOSE instruments that is useful in a wide variety of professional and hobby applications. A new offering from the Heath Company (Benton Harbor, MI 49022) is their *model IM-2410* with a frequency range of 10 Hz to 225 MHz.

Packaged in an attractive cabinet, the unit measures 3 3/8 x 7 1/4 x 9 1/2 inches

and weighs 5 pounds. The required assembly is straightforward and, depending on the builder's experience, should take just a couple of nights to complete. An assembled version, the *model SM-2410*, is also available. As usual with Heathkit products, no special tools or test equipment is required either for construction or calibration.

Speaking of calibration, we calibrated our counter using WWV as outlined in the instructions. We then checked the calibration against an accurate standard and found that they agreed to within 1 Hz. The accuracy that you will obtain depends on the care you take during calibration, but it should be well within

the requirements of most applications.

The device counts frequency over two ranges, with a choice of 1- or .1-second gate time on each. The first range is 10 Hz-50 MHz, with a sensitivity of 10 millivolts (typical) to 30 MHz, and a maximum sensitivity of 50 millivolts from 30 to 50 MHz. Resolution depends on gate time: it is 1 Hz at 1 second and 10 Hz at .1 second. The second range covers frequencies from 20 to 225 MHz, with a sensitivity of 10 millivolts (typical) throughout the range. Resolution is 10 Hz at a gate time of 1 second, and 100 Hz at .1 second.

All readings are shown on an eight-

continued on page 105

Kit Makes Electricity Cheap

NEW
TECHNOLOGY

You'll be
a little richer
after building
one of these...

Cut the cost of operating motor driven appliances and machinery AS MUCH AS 40%

\$29.⁹⁵ KIT

FACTORY WIRED \$36.95

- Reduces Your Electric Bill
- Save As Much As 40% on cost of operating Appliances & Machines
- Starts Paying For Itself as soon as it's installed
- Eligible for 15% Energy Tax Credit
- Appliances & Machines run quieter and cooler
- Protects Motors from Burn-out
- Simple Plug-in Installation
- Patented Solid State Electronics
- High Capacity 120 Volt 15 AMP, 1 HP Motor Rating
- Compact 3" x 5" x 2" Package
- Easy Assembly
- Typical Applications
 - Swimming Pool Filters
 - Furnace and Attic Fans
 - Clothes and Dishwashers
 - Freezers
 - Air Conditioners
 - Saws
 - Grinders
 - Any AC Motor Driven Device

Advanced SPACE AGE Technology now makes possible the ONLY electronic kit that PAYS FOR ITSELF and keeps on paying you a dividend by lowering your electric bill.

POWER PHASER is a patented, solid state analog mini-computer that constantly calculates the exact amount of power a motor requires to do work at any instant and automatically adjusts voltage to this precise level. Energy consumption is reduced, motor life is extended - MONEY IS SAVED.

PHONE ORDERS - Credit card or C.O.D. customers call 301-272-2860

Lincomm Corporation/Advanced Technology Systems

Dept. RE100/415 W. Bel Air Avenue, Aberdeen, Maryland 21001

Send _____ Factory Wired POWER PHASER(S)-\$36.95 ea.

Send _____ POWER PHASER KIT(S)-\$29.95-ea.

Add \$2.00 Shipping & Handling. Maryland Residents add 5% tax.

_____ Check or Money Order enclosed

Charge to: _____ Mastercard _____ Visa _____

Card No. _____ Expires _____

Bank No. (Above your name Mastercard only) _____

PLEASE PRINT CLEARLY

NAME _____ ADDRESS _____

CITY _____ STATE _____ ZIP _____

CIRCLE 69 ON FREE INFORMATION CARD

How to get the keys



to your distributor's stock room.

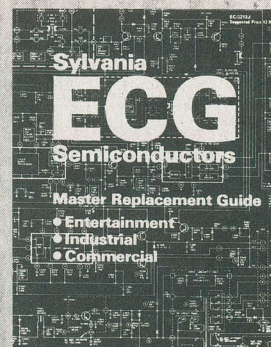
The Sylvania ECG Semiconductor Master Replacement Guide and its supplement will open the doors to one of the largest stocks of replacement parts in the world.

It cross references the industry's broadest line of diodes, ICs, special purpose devices and transistors, including the RF power types. And it includes the latest types of optoelectronic devices: IR emitters, phototransis-

tor detectors, optoisolators and LED indicators and displays.

Your local Sylvania ECG distributor is your supermarket for one-stop replacement parts shopping. And the ECG Semiconductor Master Replacement Guide is your key to his entire stock.

Get your copy of the industry's most comprehensive guide where you get your parts—at your local Sylvania ECG distributor.



Philips ECG

A North American Philips Company

BUILD THIS

HI-FI CX Decoder For Records



JOEL COHEN

Last month we presented the theory behind CBS's new compatible CX companding system for records. This month we'll show you how to build your own expander so that you can enjoy the full benefits of the new CX-encoded discs.

ONE OF THE HOT PIECES OF NEWS IN THE recording industry is the new CX* companding system developed by CBS. In audio, the word "companding" refers to a signal-processing technique in which the dynamic range of program material is compressed during the recording process, and expanded during playback. One companding system that you may be familiar with is *Dolby B*; that system, used to reduce noise in tape recordings, only works on low-level, high-frequency signals. *Dolby A* covers a wider frequency range, but is used only in professional recording applications. Other companies, such as dbx Inc., also produce professional and consumer companding systems.

Common to all of those systems is the fact that they were designed to get the best performance out of a specific recording medium and it was assumed that a compressed recording would always be played back using the appropriate expander. The frequency response and dynamic characteristics of the recorded material are therefore substantially modified during the recording process in all of those systems. Playing back a *Dolby B* recording without an expander, for example, would boost low-level, high-frequency signals by as much as 10 dB, giving the music an artificially "brighter" quality than was intended.

Companding was originally developed to compensate for the difference between the dynamic range of live music

and that of the two most popular recording mediums, magnetic tape and phonograph records. The dynamic range of live music, from ambient noise to an orchestral peak, is about 85 dB. Contrast that to the 50-dB dynamic range of a typical audio cassette-tape (as opposed to open-reel) and the 65-dB dynamic range of the very best phonograph record. The difference between the dynamic range of the actual music and that of the best record is about 20 dB.

A few years ago, dbx modified its consumer recording-tape noise-reduction system to work with phonograph records. While the resulting system increased a record's dynamic range to more than 85 dB, it still had the drawback of requiring that the record be played back using an expander. Since most record buyers are not interested enough in the extra dynamic range, and the corresponding increase in noise reduction, to invest in the required expander, *dbx*-encoded recordings are in comparatively limited distribution and sell at a premium price.

CBS Laboratories took a different approach and set out to design a *compatible* companding-system for phonograph records—a system in which recordings would sound natural and have unaltered frequency response if played back without an expander and that would provide superior-quality sound if an expander were used. The CX system was the result. While CBS expects to have at least 50 CX recordings in distribution by the end of this

year, they are also granting free licenses to other record companies. Warner Communications, RCA, Telefunken, and Teldec are among those who have already signed agreements with CBS, and records from them and from other firms should be appearing soon. In addition, the system has been adopted for use with videodiscs, and is being considered for stereo TV.

Although someone without an expander would be unable to tell that a CX-encoded recording was different from any other, to get the full benefits of the system, including 20 dB of noise reduction, he would need an expander. This article describes a CX expander that you can build yourself. With it, a CX record will sound as good as the master tape itself, and considerably better than most other signal sources. In addition, the expander described here has a peak dynamic-range expander for use with conventional records to overcome the effects of limiting.

How it works

In the CX system, signal levels greater than -40 dB below a reference (5-cm/second lateral stylus-velocity at 1000 Hz) are compressed by a 2:1 ratio. Signals below -40 dB remain linear, since compression of those signals could bring the level of the background noise above the level of the record's surface noise. The 2:1 compression is broadband, so there is no change in the signal's frequency response in the process. Also, while previous com-

*CX is a trademark of CBS, Inc.

panding systems used a single time-constant, the CX system uses four. Because of that, the action of the compressor is totally masked by the music. It is almost impossible to identify a CX disc when listening to it without an expander. In fact, substituting the system's 2:1 compression ratio for the sharp limiting of musical peaks that would be required otherwise often makes the dynamics of a CX-encoded record superior to those of a conventionally-recorded one.

During playback, signals above -20 dB (with respect to the 0-dB reference mentioned previously) are expanded by a ratio of 1:2. That is the purpose of the expander described here; its block diagram is shown in Fig. 1.

The compressed music-source passes through a full-wave rectifier circuit that is prebiased with a DC reference-voltage. That reference keeps the output of the rectifier at a constant 1/2-volt for low-level signals. Signals above -20 dB increase the output of the rectifier; a 0-dB signal results in an output of 5 volts.

The output from the rectifier goes through the main filter-circuit, and on to four additional filters that set the attack and delay time-constants for the expansion. Those time constants are the same as those used during compression. The outputs from the filters are summed, and the result is applied to the variable-gain amplifiers in the right and left channels. The resulting expansion curve is shown in Fig. 2, along with its corresponding compression curve. When the action of those two curves is combined, the result is linear, as shown by the dashed line.

Signal path

Figure 3 is a schematic diagram of the expander. The left and right channels are identical and share a common gain-control signal. The description that follows refers to the left channel.

The expander is designed so it can be connected in an external-processor loop, a tape loop, or between the pre-amp and power amp of your stereo system. Depending on how the system is configured, pushbutton switch S1 is used to select the signal source (receiver or preamp) in the SOURCE position, and the tape deck in the TAPE position). The signal is then passed through a 7-Hz high-pass filter formed by C6 and R37. Resistor R37 is the input calibration gain-control and feeds the signal to one of the sections (IC1-d) of IC1, a high-impedance, FET-input, quad op-amp. That IC has an unusually high slew-rate to meet the requirements of the subsequent stages. Op-amp IC1-d is configured for a 6-dB gain using a feedback loop consisting of R35 and R36. Its output, set for 250 millivolts at the 0-dB reference, feeds two points.

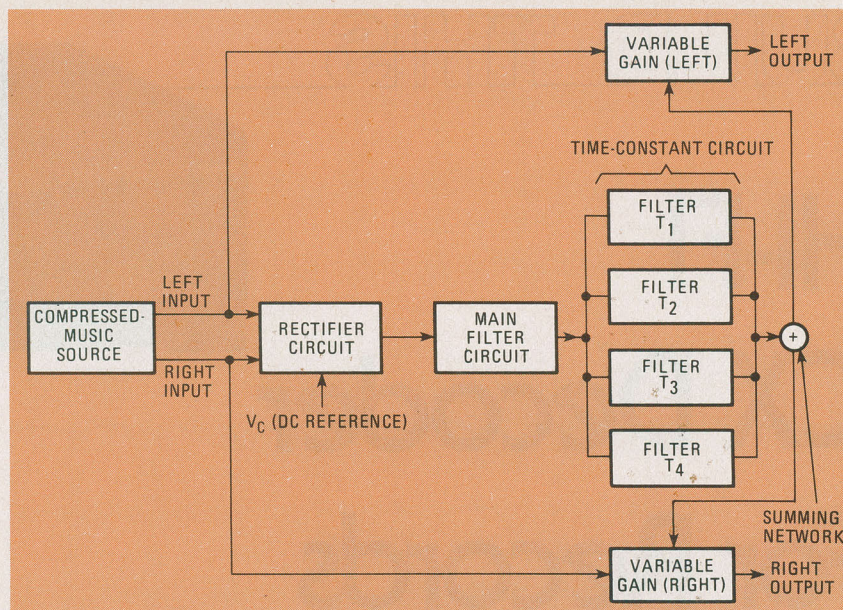


FIG. 1—BLOCK DIAGRAM OF THE CX EXPANDER shows how left and right-channel signals are combined to derive a gain-control voltage using the rectifier and filter circuits.

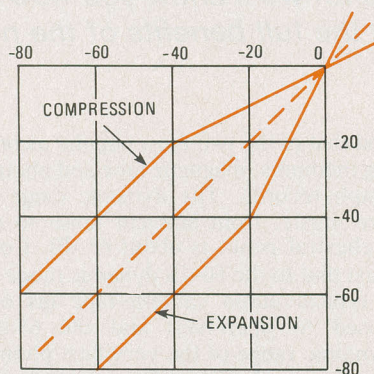


FIG. 2—THE COMPRESSION and expansion curves for the CX system. When the two curves are combined, the result is linear, as shown by the dashed line.

The first is a voltage divider consisting of R20 and R21; that divider presents a low-impedance, attenuated signal to the variable-gain stage. That stage uses IC3-a, one half of an LM13700N variable-transconductance amplifier. The attenuated signal is fed to the non-inverting input of IC3-a, and that IC's inverting input is terminated by R28. That resistor, along with R57 and trimmer potentiometer R59, are used, in effect, to null out the input offset-voltage of the IC. A signal-current proportional to the signal voltage at pin 3 appears at pin 7, and is converted to a voltage by the combination of R22-a (the front-panel VOLUME control) and R30. The ratio of the output-signal current at pin 5 to the input-signal voltage at pin 3 is controlled by the gain-setting section of the expander. To improve linearity and minimize distortion, the bias current to the input-linearizing diodes in IC3 is supplied through resistor R47. The dual emitter-follower in

IC3-a acts as a buffer for the signal voltage at pins 5 and 7, and as an output driver to pin 8. The ground reference and the AC coupling for the output signal are provided by C8 and R40. Switch S2 is used to bypass the expander when so desired.

Control path

The output of IC1-d also feeds a high-pass filter consisting of C1, C10, and R1. When switch S3 is in the CX mode, that filter has a corner frequency of 100 Hz; in the PEAK mode the corner frequency is 500 Hz. Those corner frequencies minimize any gain pumping resulting from very-low-frequency signals, such as those caused by record warp.

The output from the high-pass filter is fed to IC1-c, which is configured as a non-inverting amplifier with a gain of about 19. Musical peaks in the source signal may cause the output of that amplifier to swing almost 30 volts peak-to-peak, which is why a high-slew-rate amplifier such as the LF347N was required for IC1. Resistors R4 and R5, and IC2-d, one section of a second LF347N quad op-amp, are configured as an inverter with unity gain. The positive peaks from IC1-c are rectified by D6; the negative peaks are inverted by R4, R5, and IC2-d before they are rectified by D7. As a result, the highest positive or negative peak from either channel is detected by the base of Q2. Diodes D6 and D7 are reverse-biased by a constant DC bias provided through D5 by Q1. The level of that pre-bias is determined by a voltage divider consisting of R2, R3, and R60. When the expander is in the CX mode, R60 is bypassed and the pre-bias is approximately 1/2 volt. Thus, for signal levels up to

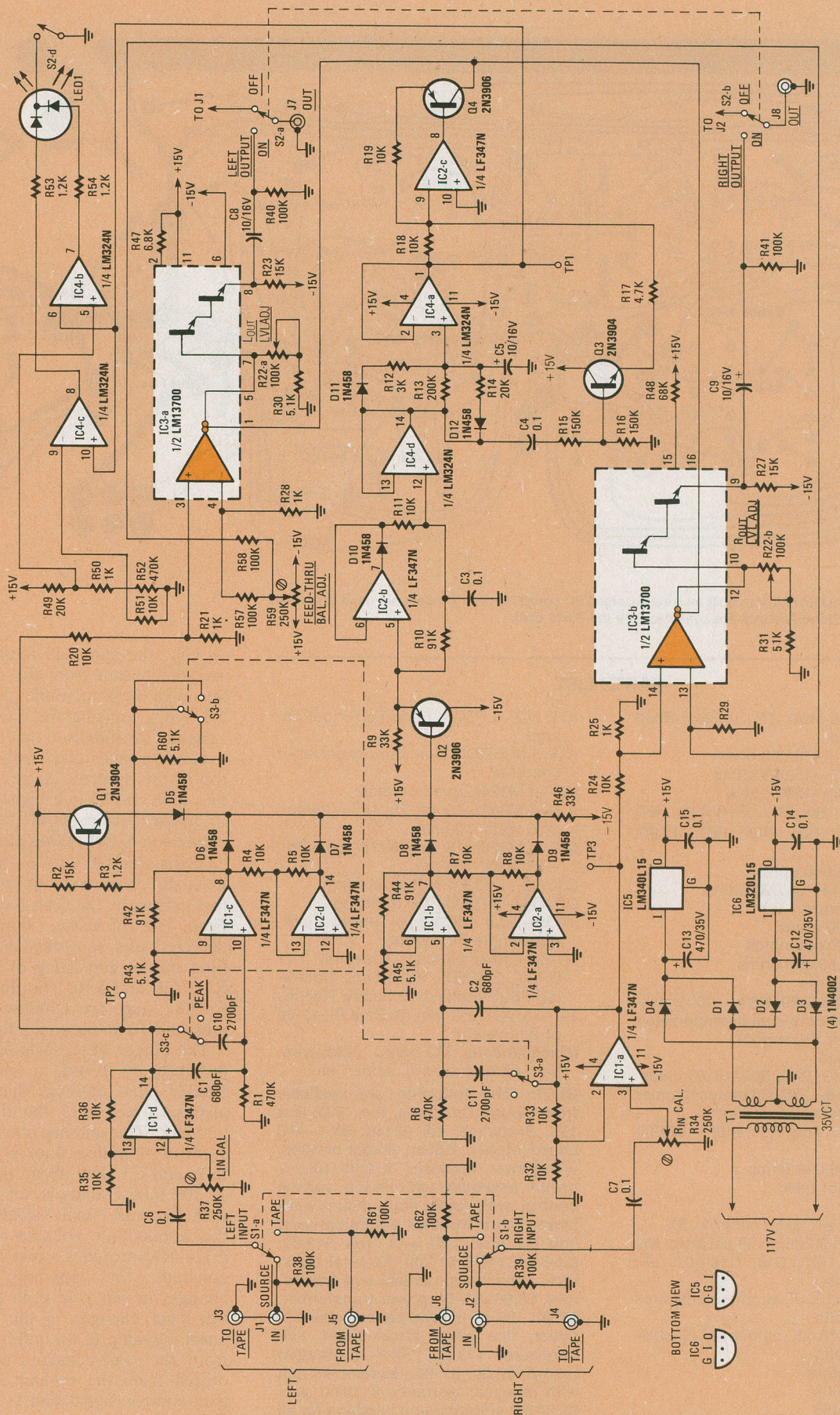


FIG. 3—SCHEMATIC DIAGRAM for the CX expander. This unit also has a peak dynamic-range expander circuit for use with non-CX-encoded discs.

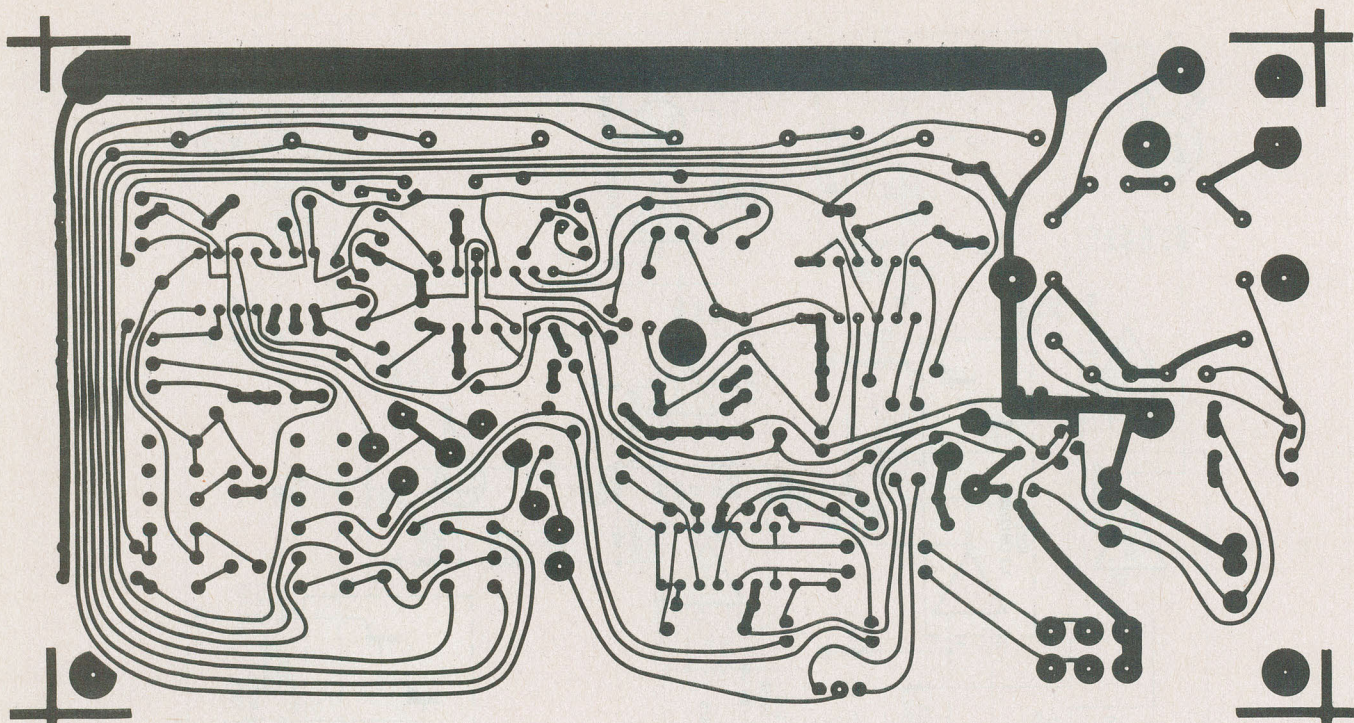


FIG. 4—THE CX EXPANDER is built on a single-sided PC board. Several jumpers are used to achieve this simplicity. Etched boards are available (see the Parts List).

PARTS LIST

Resistors, 1/4 watt, 5%, unless otherwise noted

R1, R6, R52—470,000 ohms
 R2, R23, R27—15,000 ohms
 R3, R53, R54—1200 ohms
 R4, R5, R7, R8, R11, R18-R20, R24, R32, R33, R35, R36, R51—10,000 ohms
 R9, R46—33,000 ohms
 R10, R42, R44—91,000 ohms
 R12—3000 ohms
 R13—200,000 ohms
 R14, R49—20,000 ohms
 R15, R16—150,000 ohms
 R17—4700 ohms
 R21, R25, R28, R29, R50—1000 ohms
 R22—100,000-ohm dual potentiometer, audio-taper, PC mount
 R26—not used
 R30, R31, R43, R45, R60—5100 ohms
 R34, R37, R59—250,000 ohms, trimmer potentiometer, PC mount
 R38-R41, R57, R58, R61, R62—100,000 ohms
 R47, R48—68,000 ohms
 R55, R56—not used

Capacitors

C1, C2—680 pF, axial ceramic, 5%
 C10, C11—2700 pF, axial ceramic, 5%
 C3, C4, C6, C7, C14, C15—0.1 μ F, ceramic disc
 C5, C8, C9—10 μ F, aluminum electrolytic, 16 volts
 C12, C13—470 μ F, aluminum electrolytic, 35 volts

Semiconductors

D1-D4—1N4002
 D5-D12—1N458
 LED1—dual element LED, Dialight 521-9178 or equivalent (DO NOT USE A BIPOLAR TWO-COLOR LED)

IC1, IC2—LF347N quad FET-input op-amp
 IC3—LM13700N dual transconductance amplifier
 IC4—LM324N quad op-amp
 IC5—LM340L-15 or 78L15 regulator, +15 volts, 100 mA.
 IC6—LM320L-15 or 79L15 regulator, -15 volts, 100 mA.
 Q1, Q3—2N3904 NPN transistor
 Q2, Q4—2N3906 PNP transistor
 J1-J8—dual RCA-type phono jack, right-angle PC mount
 S1-S3—three-switch assembly (1 DPDT, 2 4PDT), PC mount, Centralab PB20 series or Schadow F series
 T1—35 VCT, PC mount, Dale PL-12-09 or equivalent

Miscellaneous: PC board, case, wire, hardware, line cord, solder, etc.

NOTE: The following are available from Sound Concepts, Inc., P.O. Box 135, Brookline, MA 02146: SX-1—PC board (etched, drilled, solder masked, with power terminals), \$16.00; SX-2—switch assembly with knobs, volume control with knob, four dual-phono-jacks, three trimmer potentiometers, and the dual LED with lens, \$13.50; SX-3—IC1-IC6, \$11.00; SX-4—all resistors, capacitors, diodes, and transistors, \$8.00; SX-5—power transformer, \$7.50; SX-6—silk-screened chassis, cover, line cord, strain relief, and hardware, \$18.00; SX-7—calibration record, \$2.00; SX-80—assembled unit with one-year warranty, \$119.00. Add \$2.00 for shipping and handling for all orders within the continental United States. Massachusetts residents add 5% sales tax.

1/2 volt, the gain will remain constant and the output from the expander be linear. In the PEAK mode, the pre-bias is 3.3 volts, causing the gain to remain constant for signals to that level, so that expansion takes place only at the very top of the dynamic range. That higher bias also results in a higher gain in the CX mode than in the PEAK mode when expansion is not taking place.

Transistor Q2 acts as a buffer and level shifter to make up for the voltage loss caused by the drop across the rectifiers. The transistor's output is peak-detected and smoothed by the main-filter circuit consisting of IC2-b, D10, R11, C3, and R10. The time constants for that stage are 1 millisecond for attack and 10 milliseconds for decay.

The output of the main-filter stage is buffered by IC4-d, a section of an LM324 quad op-amp; that op-amp is also used to drive the time-constant network. The primary attack time-constant of 30 milliseconds is set by D11, R12, and C5. The decay time-constant of 200 milliseconds is set by D12 and R14. For very small signals—less than the conduction voltages of D11 and D12—R13 provides a two-second time-constant; that prevents any rapid changes in signal level in the event of low-level changes in the source material. Op-amp IC4-a buffers the output from the time-constant network; the output from the op-amp is the basic gain-control signal and is available at TP1.

A buffered high-pass filter with a 1-
continued on page 75



VIDEOTEX FOR TV: HOW IT WORKS

While it looks simple on the screen, videotex has a very complex organization. In this part we'll look at several ways of transmitting and decoding videotex, and start examining its data structure.

RICHARD LARRATT, M.A., P. Eng.*

Part 2 IN THE FIRST PART OF this series we discussed videotex in general terms. In this part we'll go into considerably more detail and explain some of the technical requirements of videotex and some ways being considered for its implementation.

We'll use the term *videotex* to mean the general practice of transmitting information to a TV receiver using the vertical blanking interval. That has also been referred to sometimes as *teletext* or *teletex*. For our purposes—and, it is expected, eventually in general usage—we'll define those terms as follows: *Teletext* can also be called "broadcast videotex," and is essentially what we are describing here—information being transmitted over the air. *Teletex* (no "t" at the end) is a computer-terminal-based information service; the best known of those services is offered by Radio Shack. *Interactive videotex* is two-way videotex, where the user can respond to the information provided on his or her TV receiver through the use of a telephone link to the videotex computer. Finally, the term *viewdata* is sometimes used as a synonym for interactive videotex.

The above terms are somewhat arbitrary—videotex is still young and definitions have not been fixed. We will use the term "videotex" to refer to a system using only the vertical blanking interval on an over-the-air or cable channel. "Teletext" will refer to one that uses a standard video format to transmit information and may or may not use that interval.

Some more terms defined

Videotex uses both alphanumerics (letters and numbers) and graphics. The alphanumerics can be produced by a simple character-generator IC or, as we'll see later, be specially defined. Similarly, low-resolution graphics elements can be stored in a character-generator ROM. Higher-resolution graphics require a more sophisticated system.

There are three videotex systems for generating graphics and special-purpose alphanumerics.

The first, *alpha-mosaic*, uses a 2×3 pixel (or *pel*) array to form various low-resolution graphics symbols. A pixel—or *pel*—is a "picture element," the smallest shape that can be displayed on a video screen. Actually, the pixels used to display ordinary alphanumeric symbols are dots, while the pixels used in alpha-mosaic graphics are small squares made up of several dots each. Personal computers such as Radio Shack's *TRS-80*'s and Commodore International's *VIC* and *CBM (PET)* use this system. Figure 6 shows the elements within a cell that are used to gen-

erate alpha-mosaic graphics characters for videotex.

Alpha-geometric graphics use elements made up of dots rather than small blocks. This means that much higher-resolution graphics are available—it is possible to construct sections of curves and, in general, produce higher-quality, less "chunky-looking," images. Exidy's *Sorcerer* computer contains a number of alpha-geometric graphics symbols that allow rather sophisticated images to be constructed. Alpha-geometrics uses a bit-mapped system, where each pixel-dot is assigned a memory location in the decoder's memory, and then transferred to the screen.

The third system is called *alpha-photographic*. It uses a bit-plane memory—several layers of bit-mapped memory—and, while it is somewhat more costly (but not terribly) to implement, and requires more time to transmit, it allows still video-frames—in black-and-white or color—to be sent.

There are two methods for transmitting alphanumeric/graphic informa-

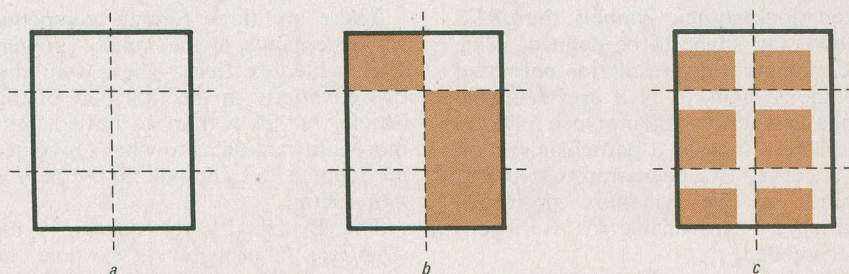


FIG. 6—MOSAIC CHARACTERS use a 2×3 pixel matrix (a). Either contiguous characters (b) or separated characters (c) can be formed.

*President, Richard Larratt & Associates Ltd.

tion. The first is referred to as *serial-attribute*. It is more or less a real-time system. As the data is received, it appears from left to right, and top-to-bottom on the screen. Its big drawback is that the information specifying what color is to be transmitted occupies a space that would ordinarily be occupied by an alphanumeric or graphic character. That means that if a transition from, say, red to blue, is made in displaying a picture, there can be a blank space on the screen where the information specifying the color change appears, since the information is meant for control, and not display, purposes. While serial-attribute transmission is reasonably simple to accomplish and is used in many systems (particularly the British), there is a better way to generate graphics.

That way is known as *parallel-attribute* transmission. There, each character transmitted carries along with it information describing its particular characteristics—generally, color, although, as we'll see, other attributes can also be described. The equipment used for parallel-attribute transmission and reception is more complex than that needed for serial-attribute data, but the results are much superior. The map shown in Fig. 7 shows how, using the parallel-attribute method, colors can be changed "on the fly." It is also interesting to note the use of alpha-mosaic graphics characters made up using the elements shown in Fig. 6.

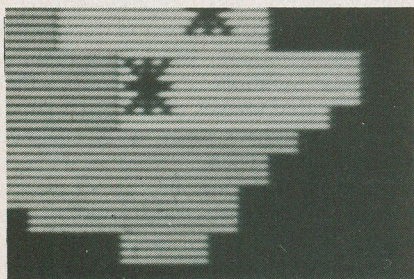


FIG. 7—ENLARGED SECTION of map drawn using Antiope shows benefits of parallel-attribute transmission. Also, note odd-shaped graphics characters used to form border.

There are two terms that remain to be defined—at least for the moment. They are "DRCS" and "PDI."

DRCS stands for Dynamically Redefinable Character Set. As opposed to fixed block-graphic symbols, the DRCS allows any shape to be defined, using the maximum dot-resolution permitted by the system. It is a user-definable alpha-geometric system. Once a DRCS character, such as a particular section of a curve, has been transmitted and stored in the videotex decoder's memory, it is available for use whenever needed.

This brings us to PDI's (Picture Description Instruction). They permit an intelligent decoder to reproduce images

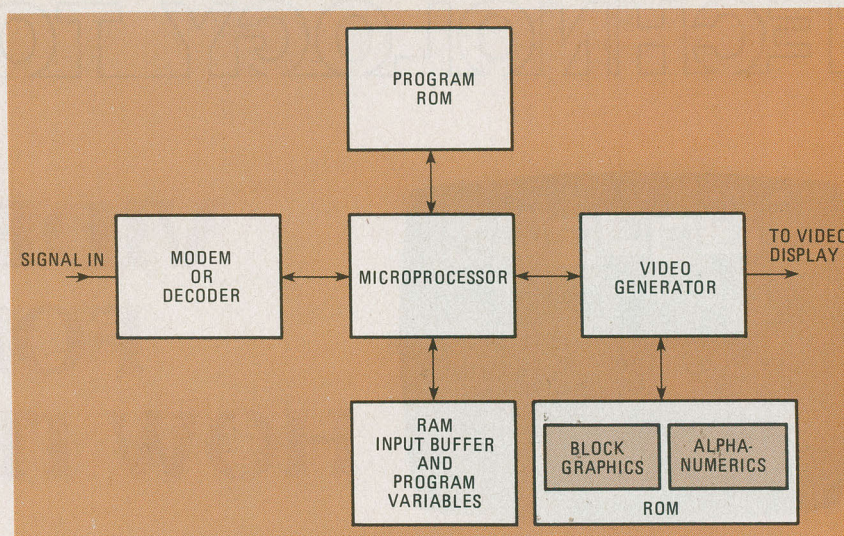


FIG. 8—BLOCK DIAGRAM OF PRESTEL SYSTEM. Note that display is limited to block graphics and alphanumeric characters stored in ROM.

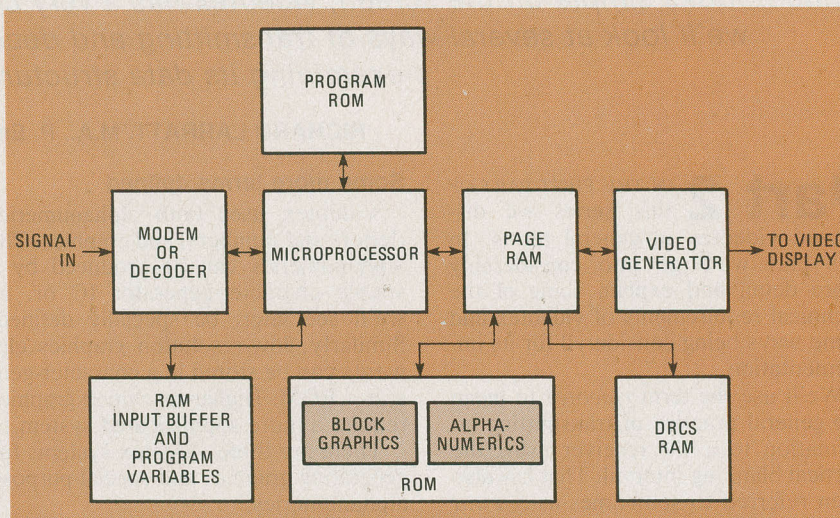


FIG. 9—ANTIOPE ADDS DRCS RAM for customer character-generation. The addition of page RAM allows the system to store video data, and instructions for displaying it, separately.

in extreme detail. Typical PDI's include ARC, LINE, POLYGON, and, of course, TEXT. Using PDI's, a complete set of DRCS's need not be sent. Instructions can be given to draw a straight line, or curve, from one point to another. The decoder can be provided with a DRCS and the PDI's used to manipulate them. PDI's and DRCS' are extremely powerful videotex tools.

System characteristics

There are three formats competing for acceptance in the rapidly growing U.S. videotex field. They were discussed briefly in the first part of this article, but now that we have a little more information as to what's involved in videotex, we can talk about them in more detail.

The British Prestel system is the simplest, and probably, at this time, the most widespread. Its simplicity lies in the fact that it is alpha-mosaic in nature and uses the serial-attribute system.

The equipment required for it, shown in block form in Fig. 8, is less sophisticated, and less expensive, than for the other systems. Unfortunately, when graphics are called for—and, after all, that's what TV sets are good for—Prestel falls short. Still, there are many who argue that Prestel is the best way to get videotex into the greatest number of homes at the least expense.

Antiope, the French-developed system, is more sophisticated in that, while still alpha-mosaic, it uses parallel-attribute transmission. That means that, while the equipment required for it is more complex (Fig. 9), and requires several thousand bytes of RAM (Random-Access Memory), its graphics capabilities are greater. Through the use of DRCS', higher-quality images can be presented. As we'll see, Antiope is a serious contender in the videotex race.

Finally, there's Telidon, the Canadian system, shown in Fig. 10. Telidon is

alpha-geometric and uses parallel-attribute transmission; what's more, it also makes use of DRCS' and PDI's. Telidon's bit-plane memory allows for complex and detailed graphics, and permits the use of the alpha-photographic mode. It's the most advanced videotex system to date.

Until recently, Prestel was probably the logical choice for videotex because of the complexity and relative expense of the other two systems. However, the circuitry required for such niceties as parallel-attribute transmission (and reception) and higher-resolution, more complex, graphics, can now be handled by microprocessors and a few LSI or VLSI (Very Large-Scale Integration) IC's and, in mass production, the increase in cost over what would be required for Prestel is negligible.

A factor that figures heavily in making the decision as to which videotex standard should be adopted is that Antiope and Telidon can be made compatible, because of their parallel-attribute nature, while Prestel, a serial-attribute system, is unique.

That probably played an important part in defining what has come to be known as the North American Broadcast Teletext Specification.

North American Broadcast Teletext Specification

Despite the simplicity of the British Prestel system, the fact that a higher level of videotex technology exists has caused us to consider adopting either the Antiope or Telidon systems, or a combination of the two.

While the controversy continues, the EIA (Electronic Industries Association) has put forth a proposal to the FCC to adopt as a standard an Antiope/Telidon-based system. That is known as the North American Broadcast Teletext Specification. (We'll try to avoid using the term too frequently.)

In essence, the NABTS calls for an Antiope system, with Telidon enhancements. Its Presentation Level Protocol (the description of how the data is to be transmitted) was proposed by AT&T and subsequently endorsed by CBS, which had submitted a similar proposal, but with minor differences.

Videotex protocol levels

There are seven layers (levels) of protocol involved in videotex. They are:

1. Physical—Provides the mechanical and electrical provisions for the physical interconnection.
2. Link—Provides ways of establishing and maintaining data links between parts of a network.
3. Network—Provides the means to exchange network service data units over a network.
4. Transport—Provides a universal transport mechanism for lower-level protocols.

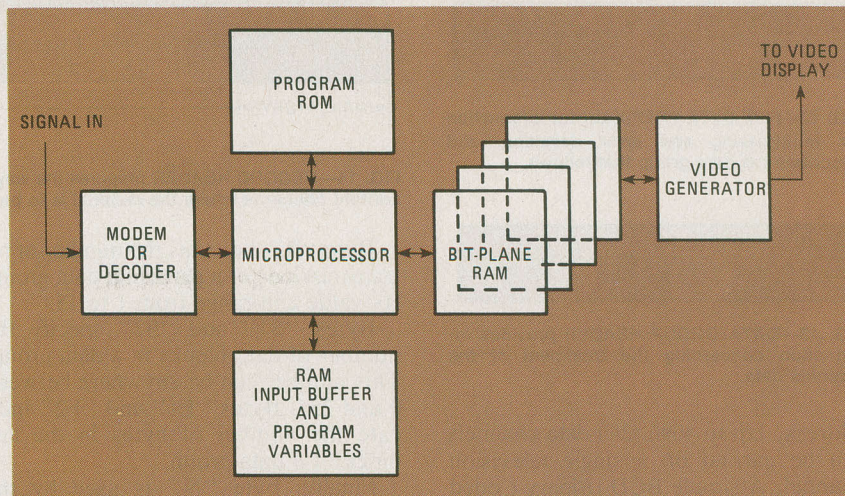


FIG. 10—TELIDON USES MORE RAM than other systems. Four layers of bit-plane RAM permit complex graphics and use of the alpha-photographic mode.

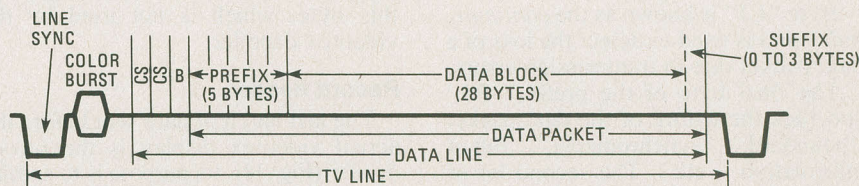


FIG. 11—SINGLE VIDEO LINE carrying information required for the presentation of videotex. Data representing material actually displayed does not appear on this line.

5. Session—Provides for the combination and/or separation of two presentation entities.
6. Presentation—Provides the method of coding and presenting information.
7. Application—Invokes the protocol requested by the user.

In this part we'll concern ourselves with the levels up to, but not including, the presentation protocol.

Videotex information is intended to be transmitted on lines 15 and 16 of the vertical blanking-interval. Lines 17 and 18 may also be used to increase the amount of data that can be sent, but lines with lower numbers are out of the question, since they can be visible on some TV receivers.

Another form of videotex, known as *full-field* uses all the video lines, transmitting video information on the visible lines and control and other information in the vertical blanking-interval.

Videotex data is sent at the rate of 5,727,272 bits per second. If lines 15 and 16 are used, this works out to an effective baud rate of approximately 22,000. Because of this relatively high rate of data transfer, it is important that the received signal be as clean as possible. Of particular concern are "ghosts" and ignition noise, which can garble the true data being transmitted. Complex error-protection techniques (Hamming encoding) are used for videotex transmissions, but even so, a clean signal is required for reliable results. While this is not as much a concern to cable videotex systems as it is to broadcast video-

tex, it is still a factor to be contended with.

Another concern is that the data-transmission frequency is very close to the maximum bandwidth of 6 MHz allocated for broadcast stations, and that spillover may occur. This is particularly disturbing to operators of cable systems, where channels may be packed one next to the other. Continued testing is sure to show a way to minimize or eliminate these potential problems.

Figure 11 shows a TV line in the vertical blanking-interval carrying videotex information. The line can contain up to 288 bits (36 8-bit bytes).

The first two bytes ("CS," "CS") are the *bit-synchronization sequence*. They provide a videotex decoder with a reference burst that synchronizes the decoder's clock and initializes the data slicer that extracts the videotex information.

The next 8-bit byte, "B," is the *framing code*, and defines the structure of the rest of the line. This byte has the binary structure "11100111," with the least-significant bit (at the right) being sent first. Two other framing codes have been reserved for future use.

The prefix

After the bit-synchronization sequence and framing code, a domain of data known as the *data packet* begins. It starts off with a 5-byte *prefix*, shown in detail in Fig. 12.

The first three bytes of the prefix, "P1"-"P3," define the data-packet



FIG. 12—FIVE-BYTE PREFIX carries information for multiplexing and error detection, and describes the data group that follows.

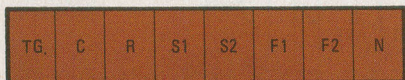


FIG. 13—DATA GROUP HEADER provides information concerning the treatment of the videotex data.

address. Up to 4096 (2^{12}) data channels can be carried on a single television channel. A simple BCD (*Binary Coded Decimal*) keypad can be used to select any of the first 1000 pages; the rest are reserved for future use.

Byte "CI" is known as the *continuity index* and is used to detect the loss of a data packet due to transmission errors.

The final byte of the prefix, "PS," specifies the nature of the data packet ("standard," "synchronizing," "full of information," etc.). The second bit of byte "PS" indicates that a *data group* follows.

The data group header

The next group sent is an 8-byte sequence, the *data group header* (Fig. 13). It tells the decoder what is coming up.

The first byte, "TG," tells the decoder what type of processing is to be applied. Broadcast videotex always sets the value of this byte to zero. The second byte, "C," verifies the sequence of data groups of the kind defined by "TG" in a particular data channel (defined by "P1"-"P3" in the prefix).

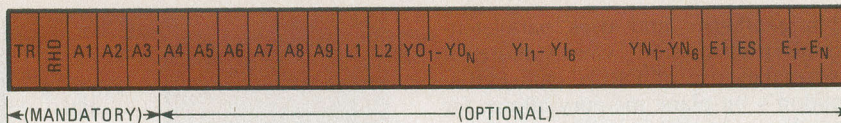


FIG. 14—RECORD HEADER prepares the way for the videotex material to be displayed. Much of its content concerns where the material is to be found, and how it is to appear.

Byte "R" indicates the number of re-transmissions of a particular data group. Its value can range from 1 to 15.

Bytes "S1" and "S2" specify the number of data blocks in a data group. This number can be anywhere between 0 and 255. Bytes "F1" and "F2" indicate the number of bytes in the last block of a data group.

Finally, byte "N" is used by the broadcaster to identify the routing of the data group through his network. Values from 0 to 15 can be assigned to this byte, which is not used by the videotex decoder.

Record header

The last batch of data sent before the actual videotex display is the *record header* (Fig. 14). Its purpose is to specify the qualities of the videotex material further. It is divided into a 5-byte mandatory section, and a following optional group that may or may not be transmitted.

The first byte of the mandatory section, "TR," indicates whether the transmission is broadcast videotex, closed captioning, or some other form of data transmission. Byte "RHD" can be used to indicate the presence of one or more subgroups consisting of: address extension, record linking, complementary record classification, or header extension field.

Bytes "A1"-"A3" contain the record or page number. Bytes "A4"-"A7" are optional. When they are used, bytes "A1"-"A7" represent the page number, and byte "A8" and "A9" represent the page number within a document.

Bytes "L1" and "L2" are linking bytes—they tell the decoder where to look for records that are to appear sequentially.

The whole class of "Y" bytes carries information pertinent to the retrieval and display of the videotex data. Among other things, it can indicate whether a message is to be superimposed over the image being displayed, whether a message is to be withheld until requested by the user, whether a message has priority and should override the image being displayed, etc.

Bytes "E1" and "ES" indicate the presence and length of any header extension fields ("E1"-"E8").

Where's the picture

By now you can realize how complicated videotex is, and, perhaps, why there is such contention over how it should be implemented. Why, we haven't even begun to answer the question of how the videotex image gets on the screen! That will come next month, when we discuss DRCS', PDI's, and, finally, how videotex becomes visible.

R-E

VIDEO ENTERTAINMENT '82 a special supplement

In our next issue, January 1982, Radio-Electronics will present a special supplement—virtually a magazine within the magazine—dealing with the phenomenal video "revolution" that is sweeping across our society. It will be chock full of pertinent technical data and information that you will want to keep for reference and decision-making.

We will take a close look at tomorrow's home-entertainment system, with a TV set as the core receiving/reviewing unit to which all electronic components are attached: personal computer, VCR, video disc, video games, cable, and other software.

We'll present accessories that can enhance the performance of your video system and, among the other features, you'll find comprehensive discussions on the latest in such areas as projection TV, VCR's and cameras.

The January 1982 issue goes on sale December 17, 1981; don't miss it!



DAN AND DIANE TALBOT

Just in time for the holiday season, here are four electronics toys that are sure to delight any young person.

WITH THE HOLIDAYS RAPIDLY APPROACHING, MOST PARENTS (as well as grandparents, aunts and uncles, etc.) are in the midst of their annual search for a present that their child will enjoy. Your local toy store, however, is not the only place to look for such a present. Often, a simple electronic toy that you build for your child, or help your child to build for himself or herself, will be far more appreciated and enjoyed than most. The toys described in this article were designed for their ease of assembly, the availability of parts, and, I hope, to appeal to a child's curiosity. In addition, they are fun to build. The theory of operation of each is fully explained, making them educational for the builder, as well as entertaining for the child. Those toys also make good "science fair" projects for children up to junior high-school age.

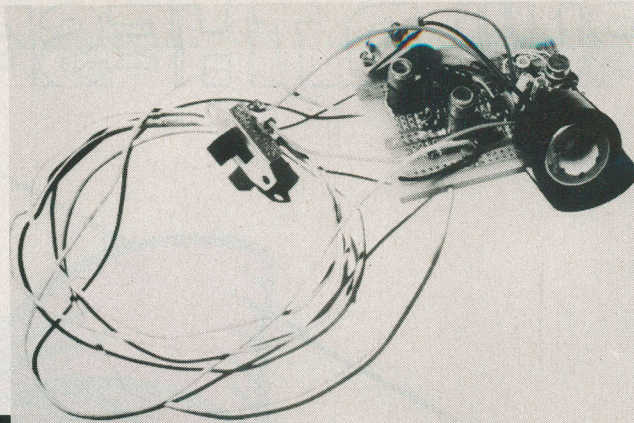
You can build any of the toys with just a handful of new or junk-box parts. The siren requires only two easy-to-obtain transistors, a few resistors and capacitors, a pushbutton switch, and a battery. The bird-chirper requires only four standard transistors in addition to the resistors, capacitors, and the like. The AM wireless microphone requires two transistors, a common op-amp IC, and a couple of tuning coils; incidentally, projects similar to that have long been favorites with young people. The electronic "chug-chug" simulates the sound of a steam locomotive with variable speed, and uses a design that doesn't need a special noise diode, selected transistors, or Zeners. While the chug-chug is

the most complicated of the projects, it still should not take more than a weekend to finish, depending on the builder's experience.

Before we get into each project in detail, let's go over a few points about selecting parts. While you should have no trouble finding most of the parts, you may run into a situation where a particular listed part is not available locally. In that case you have two alternatives: order it by mail (the advertisers in the back of this issue are a good source), or find a suitable substitute. There are a couple of choices listed for many of the critical components, and while those are the ones that will work the best in a particular circuit, in most cases (the exceptions are noted in the text) there are others that will work. For instance, IC1 in the "chug-chug" toy is listed as a CA3240. Actually, that IC is a dual CA3140 (that is one possible substitute). Acceptable substitutes include a TL062, a TL072, or a TL082 IC, although those IC's have a lower noise-output. In fact, almost any dual MOSFET-input op-amp can be used if you know its pin-out.

One note about the capacitors: While ceramic discs can be used with good results in most situations (except where electrolytic or tantalum types are specifically called for), if you are buying new parts, you may want to consider Mylar or mica capacitors instead. While those are more expensive, they are precision units and, depending on the application, they may provide better results.

1. WIRELESS AM MICROPHONE



The schematic for the wireless AM microphone is shown in Fig. 1. Transistor Q1 and its associated components comprise a tuneable RF oscillator. This oscillator generates an RF signal in the AM broadcast band. The output frequency of the oscillator is tuned by coil L1 to an unused frequency between 800 and 1200 kHz. The RF signal is fed to transistor Q2, which serves as the modulator. Operational amplifier IC1 increases the level of the audio signal from the microphone, and applies it through resistor R4 to the base of Q2. The amplified audio signal varies the bias current of Q2. The non-linear characteristic of Q2 results in an amplitude-modulated RF signal that is taken from the emitter of Q2, and connected to the antenna via a matching network consisting of C6, L2, and R6. The antenna itself is a 7- to 10-foot length of insulated, stranded hookup-wire.

The audio sensitivity is determined by the output level of the microphone used, and by the value of R10. The value shown for that resistor will give you adequate sensitivity when using a 600-ohm or higher impedance dynamic-type

microphone, similar to the inexpensive ones (generally less than five dollars) sold for use with audio cassette recorders.

Construction details

You can build the wireless microphone using any one of a number of construction techniques. However, the easiest method to use for this project would be wire-wrap. First mount the components on perfboard using wire-wrap posts. Use a wire-wrap IC socket for IC1. Then, following the schematic, connect the posts using a wire-wrap tool. As with any other RF circuit, keep the wiring short and neat, and avoid locating the antenna, L2, C6, R6, L1, C5, or C3 near pins 2 or 3 of op-amp IC1. Also, keep L1 away from L2 so that no interaction occurs. When connecting the microphone, be sure to use shielded cable to prevent hum pickup.

After construction is completed, turn on an AM radio and tune it to an unused frequency between 800 to 1600 kHz. Then turn on the wireless microphone and place it next to the radio. Tune L1 until you hear a change in the audio level coming from the radio. Whistling into

the microphone while you tune L1 will help you recognize when L1 is tuned correctly.

Use an RF probe and a VTVM to monitor the output voltage from the antenna, and peak it by adjusting L2. (Alternatively, the "S" meter of a general-coverage receiver tuned to the correct frequency can be used.) If L1 is disturbed, it may be necessary to readjust L2 for peak performance. Depending on the impedance of the microphone you chose, the audio sensitivity (gain) can be increased by decreasing the value of R10, and vice-versa.

PARTS LIST—AM WIRELESS MICROPHONE

Resistors ¼ watt, 5%, unless otherwise noted

- R1—1000 ohms
- R2, R4, R11—2200 ohms
- R3—560 ohms
- R5—270 ohms
- R6—33,000 ohms
- R7, R8—100,000 ohms
- R9—2 megohms
- R10—4700 ohms (nominal, see text)

Capacitors

- C1—.01 μ F, ceramic disc
- C2—.047 μ F, Mylar or ceramic disc
- C3—470 pF, mica or ceramic disc
- C4—1000 pF, Mylar or ceramic disc
- C5—33 pF, mica or ceramic disc
- C6—220 pF, mica or ceramic disc
- C7—330 pF, mica or ceramic disc
- C8, C10—1 μ F, 10 volts or higher, electrolytic
- C9—0.22 μ F, mica or ceramic disc
- C11—10 μ F, 6 volts or higher, electrolytic

Semiconductors

- D1—1N914
- IC1—CA3140 op-amp
- Q1, Q2—2N3904, 2N2222, or equivalent general purpose NPN transistor
- L1, L2—68-180 μ H "loopstick" AM-radio oscillator coil (Miller 9055, Miller 9018, or equivalent)
- B1—9-volt battery, transistor-radio type
- J1—phono jack
- S1—SPST switch

Miscellaneous: wire, solder, stranded hookup wire (for antenna, see text), etc.

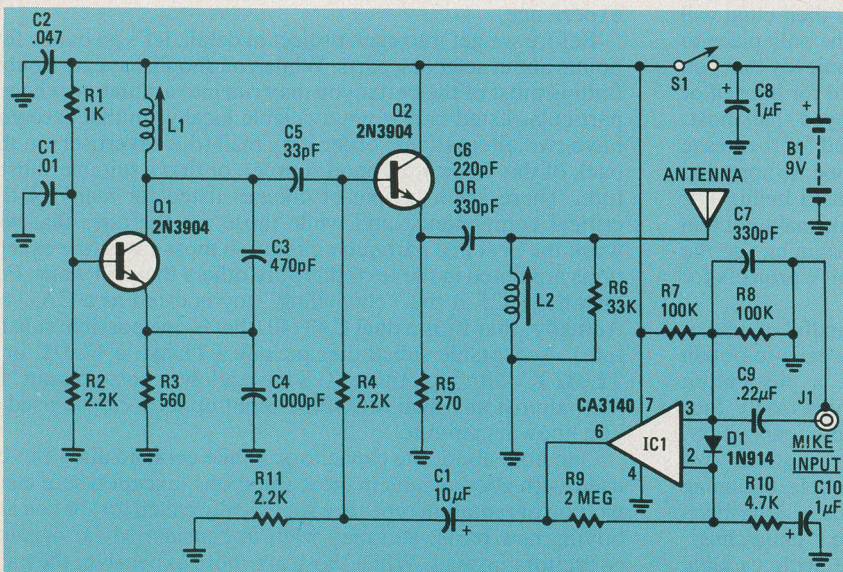
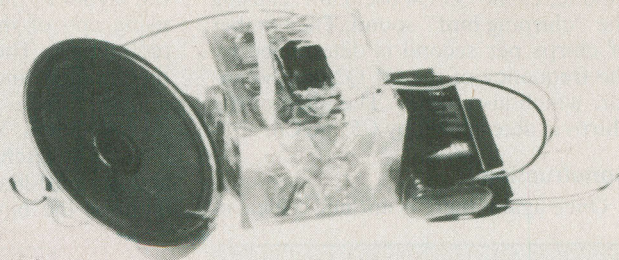


FIG. 1—A GOOD INTRODUCTION to the principles of radio, AM wireless microphones have long been a favorite with young people.

2. ELECTRONIC SIREN



The schematic diagram of the siren is shown in Fig. 2. The "wailing" sound of the siren is generated by a variable-frequency oscillator consisting of Q1 and Q2. Capacitor C2 provides the feedback for the oscillator. The frequency of the oscillator is varied by the voltage applied to the base of Q1 through R3. When switch S1 is closed, capacitor C1 charges, thus increasing the oscillator frequency. When S1 is released (opened), capacitor C1 discharges and the oscillator frequency decreases. Capacitor C3

limits the maximum oscillator frequency. The average battery current drain is about 15 millamps.

Construction

You can build the siren using any construction method you choose; there is nothing critical about the layout. Be sure to use only the transistors listed for Q2. You have a little more flexibility in choosing Q1, as long as it is equivalent to the ones listed. Use a miniature push-button-switch for S1. When S1 is

closed, the siren will begin its upward wail; a slow, downward wail will begin as soon as S1 is released.

The loudspeaker should be a miniature 8-ohm transistor-radio type. You can change the overall pitch of the siren by changing the value of R3. If you decrease the value of R3, the overall pitch of the siren will increase. Too small a value of resistor R3, however, could make the oscillations stop prematurely, provided that switch S1 is held down long enough.

PARTS LIST—SIREN

Resistors, 1/4 watt, 5%, unless otherwise noted

R1, R4—7500 ohms

R2—33,000 ohms

R3—270 ohms

R5—4.7-10 ohms

Capacitors

C1—100 μ F, 10 volts or higher, electrolytic

C2—.0068 μ F, Mylar or ceramic disc

C3—1 μ F, 10 volts or higher, tantalum or electrolytic

Semiconductors

Q1—2N3904, 2N2222, or equivalent NPN transistor

Q2—MJE370 or 2N4919 PNP transistor

B1—9-volt battery, transistor-radio type

S1—SPST momentary pushbutton-switch, normally open

Miscellaneous: wire, solder, 8-ohm speaker, etc.

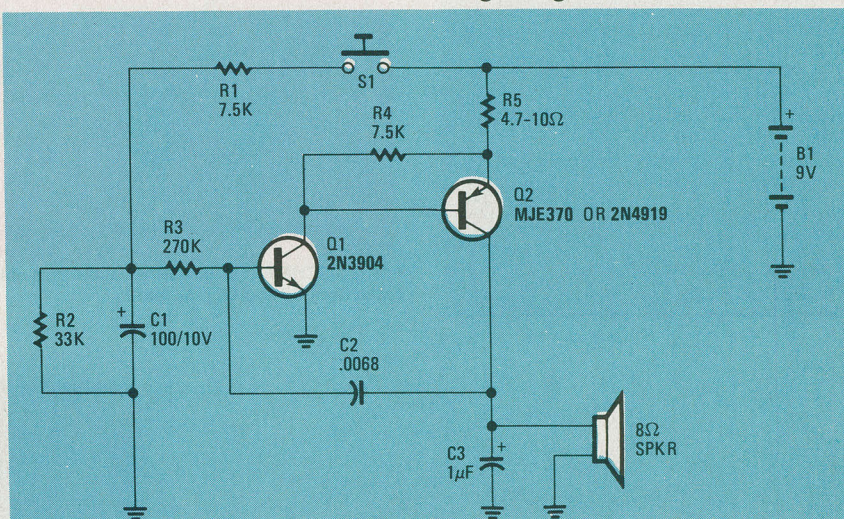
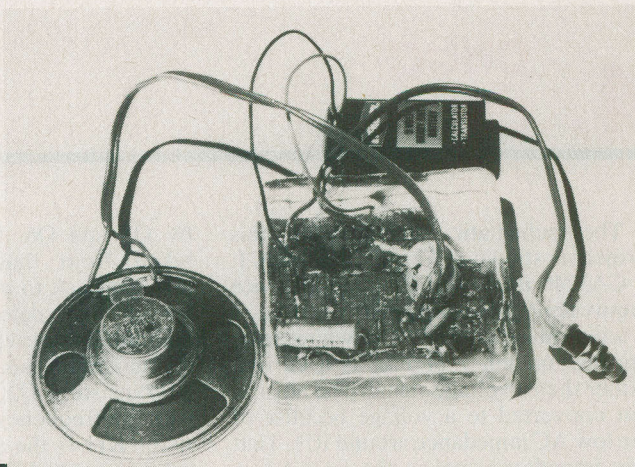


FIG. 2—EASE OF CONSTRUCTION makes this electronic siren a great first-time project for your child. Be sure to use only the transistors listed for Q2.

3. ELECTRONIC BIRD CHIRPER



The schematic of the electronic bird chirper is shown in Fig. 3. Transistors Q1 and Q2 form the two halves of a free-running multivibrator whose fre-

quency is determined by the voltage across C8. That capacitor is charged and discharged by closing and opening switch S1.

Transistors Q3 and Q4 make up a variable-frequency oscillator similar to the one used in the siren. The output of the free-running multivibrator frequency

modulates the Q3-Q4 oscillator, causing the "chirping bird" sound. The number of chirps per second is determined by the frequency of the Q1-Q2 multivibrator, which also varies. The pitch of the chirps is determined by C5 and C6.

Construction

Once again, there is nothing critical in

the layout of this project; it can be built using any of the popular construction techniques. The chirping is controlled by opening and closing switch S1, a normally open, momentary SPST push-button switch. When you finish the circuit, if the pitch of the chirps is too low and not bird-like, you can omit C5; but monitor the battery current if you do

so. (If you can, substitute a current-limited power supply for the battery while you are testing the circuitry; doing that will prevent the battery from draining. If the current drain exceeds 50 milliamperes when S1 is closed for a second or so, you should raise the value of C6. Be sure to use the listed transistor for Q4.

PARTS LIST—BIRD CHIRPER

Resistors, 1/4 watt, 5%, unless otherwise noted

R1, R8—20,000 ohms
R2, R4—4700 ohms
R3—12,000-18,000 ohms
R5—180 ohms
R6—5600 ohms
R7—120,000 ohms

Capacitors

C1, C3—10 μ F, 6 volts or higher, electrolytic
C2—3300 μ F, 10 volts or higher, electrolytic
C4—.0047 μ F, Mylar or ceramic disc
C5—0.1 μ F, Mylar or ceramic disc
C6—.02 μ F, Mylar or ceramic disc
C7—200 μ F, 10 volts or higher, electrolytic
C8—100 μ F, 10 volts or higher, electrolytic

Semiconductors

D1—1N914
Q1—Q3—2N3904, 2N2222, or equivalent NPN transistor
Q4—MJE370 or 2N4919 PNP transistor
B1—9-volt battery, transistor-radio type
S1—SPST momentary pushbutton switch, normally open

Miscellaneous: wire, solder, miniature 8-ohm speaker, etc.

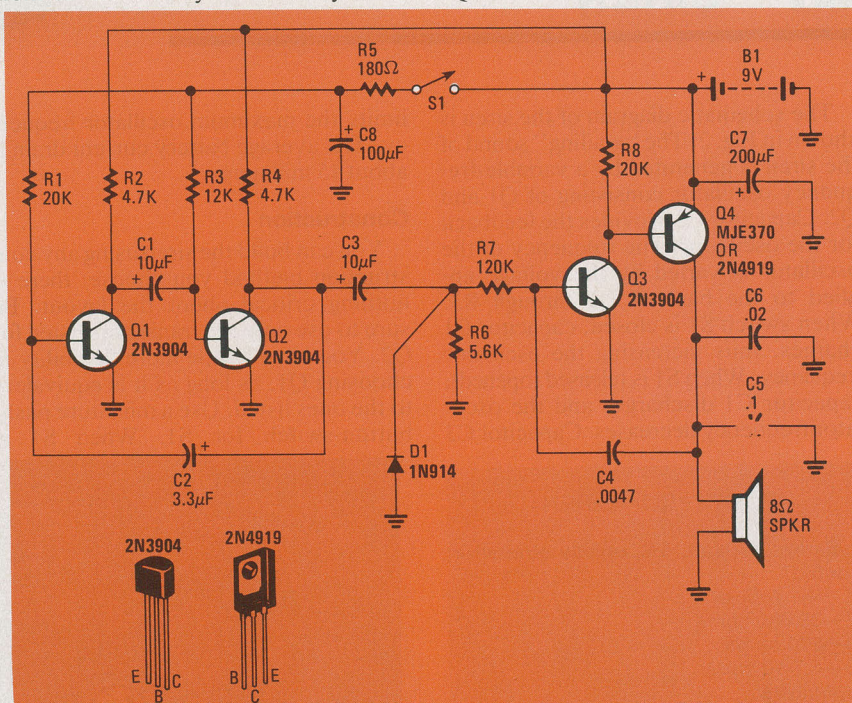


FIG. 3—SCHEMATIC DIAGRAM of the bird-chirper toy. The pitch of the bird sounds is determined by capacitors C5 and C6 (see text).

4. CHUG-CHUG

The schematic diagram for this project is shown in Fig. 4. Op-amp IC1, a CA3240 dual MOSFET-input device (equivalent to two CA3140's), is used as a white-noise source. The white noise appears on pin 7 of IC1 as a current rather than a voltage signal. The noise is not converted to a voltage because of the low AC impedance around IC1. That low impedance makes the layout less critical than for other types of noise sources, and eliminates the need for shielding to prevent hum pickup.

Op-amp IC2 is used as a driver stage for the push-pull output stage formed

by Q5 and Q6. Negative feedback is taken from that output stage and brought back to pin 2 of IC2. Resistors R6 and R8 determine the minimum amount of negative feedback, and hence the maximum gain.

Transistors Q2, Q3, and Q4 form a variable-frequency multivibrator; resistor R11 is the SPEED control, and is used to control the multivibrator's frequency. The output from the multivibrator is differentiated by C8, and is then applied to modulator transistor Q1 through D1 and R7. Transistor Q1 modulates the gain of the output-amplifier

stage by changing the impedance to ground seen by R6 and C4. That creates chopped white-noise; there is also residual low-level noise from IC2 when Q1 is not conducting. When the multivibrator's frequency is reduced using R11, C8 discharges slowly, creating a sound similar to escaping steam from a stopped locomotive. As the multivibrator's frequency is increased, the toy generates a sound like an accelerating locomotive.

Construction details

The only thing to keep in mind when

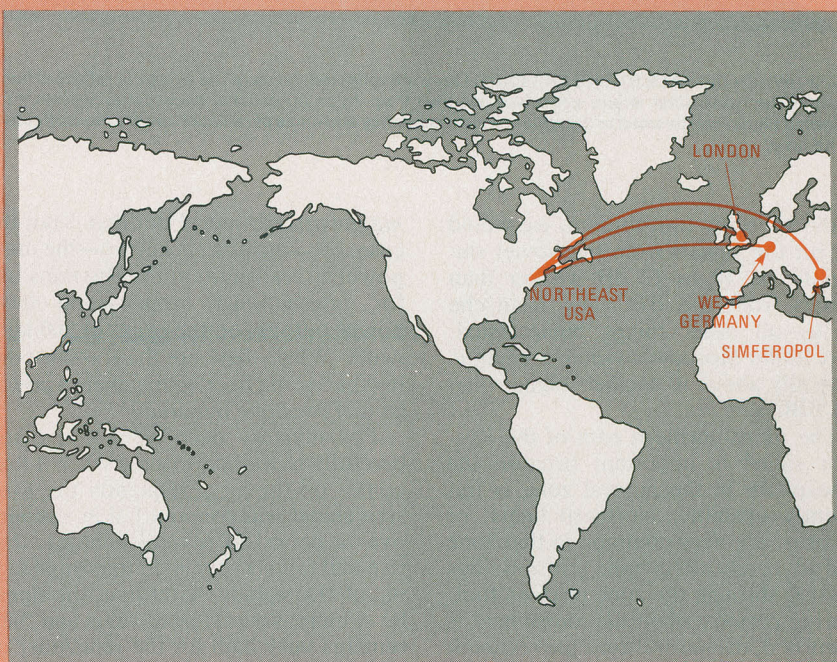
continued on page 93

Why Radio Moscow is WINNING the dB WAR

If you are an SWL'er, you may have noticed that Radio Moscow's signal appears much stronger than its competition's. We can't be certain why, but this may be the reason.

***STANLEY LEINWALL**

FIG. 1—SIGNALS FROM THE RUSSIAN TRANSMITTERS at Simferopol travel more than 1,000 miles farther than those from the BBC or Deutsche Welle. They also follow a more northerly path, putting them closer to the auroral zone.



RADIO MOSCOW'S ADDITION OF A WORLD Service in English several years ago provided yet another example of the strong emphasis the Russians have placed on shortwave broadcasting as a highly effective and economical medium for the mass dissemination of information. (A "World Service" is a 24-hour-a-day operation that serves all parts of the world; that differs from Moscow's earlier English-language service where broadcasts occurred only at certain times of day and were aimed only at English-speaking regions.) The Russians are by far the world's largest broadcaster. Using approximately 200 shortwave transmitters operating around the clock, they transmit in 65 different languages and dialects to virtually every corner of the globe.

The Soviet effort in broadcasting has not been concentrated solely on quanti-

ty. Listeners here in North America have observed that many Soviet shortwave signals are stronger than most competing broadcasts. In some cases, signals coming direct from the USSR are stronger than the relays coming from Cuba, leading you to believe that radiated power levels from the Russian-based transmitters are enormous.

Technically, however, one would not expect that to be the case, and there is, in fact, growing evidence to indicate that the Russians are instead considerably ahead of the West in the application of antenna and propagation theory for long-distance shortwave communication.

As an example, consider one of the principal transmitting sites used by the Soviets for their broadcasts to North America. Located in Simferopol, in the Crimea, it is approximately 5000 miles

from the northeastern United States. Yet, signals from that transmitter site are considerably stronger in North America than signals from the BBC and Deutsche Welle, in spite of the fact that the transmitters for the latter two are at least 1000 miles closer to their target areas.

The world map shown in Fig. 1 illustrates the normal paths that those signals travel. Note that not only does the Russian signal need to travel more than 1,000 miles farther than the signals from the BBC and Deutsche Welle, but that the path of the Soviet signals is farther north and closer to the auroral zone. Both factors are quite significant.

In general, the farther radio signals must travel from a transmitting station, the weaker they are. Based on the location of the BBC, Deutsche Welle, and

*Stanley Leinwall is Director of Engineering, U.S. for Radio Free Europe—Radio Liberty.

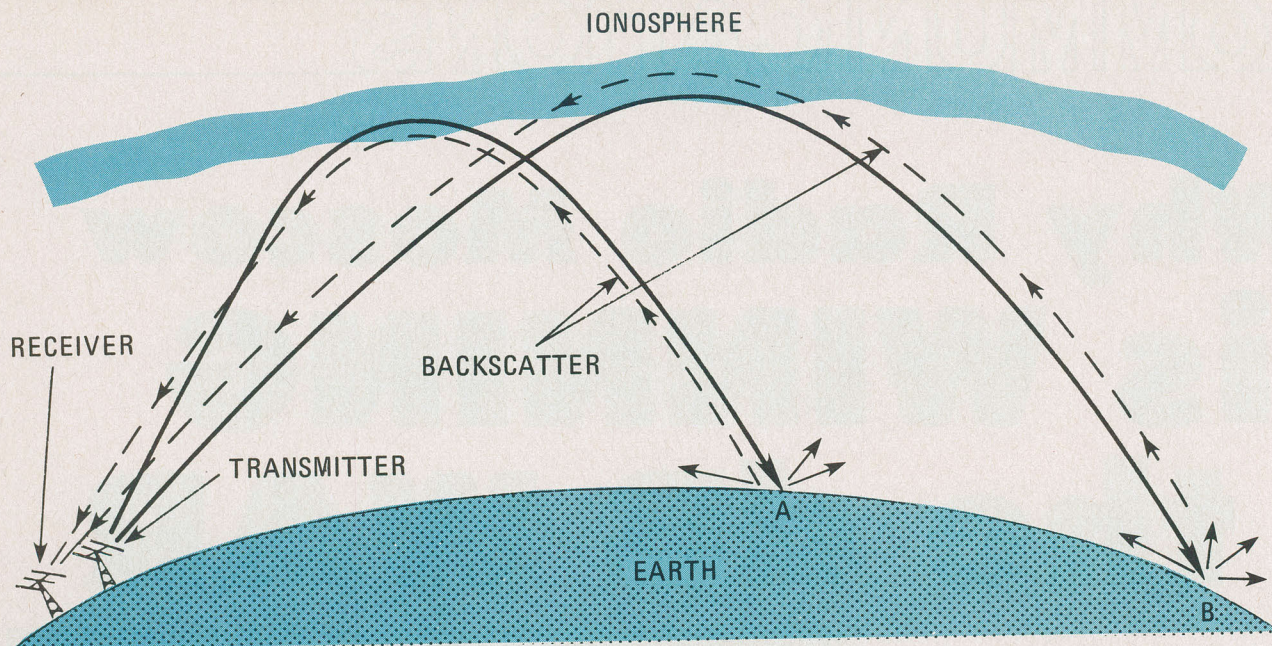


FIG. 2—WHEN SIGNALS STRIKE THE EARTH they are reflected; some of the energy is reflected back towards the transmitter where a receiver can pick it up. In an operational backscatter system, that reflected signal can be used to determine which frequency and angle of radiation are the most effective at the time.

Radio Moscow transmitters, we would expect the signals from the Soviet station to be 10 to 12 dB weaker than signals from the BBC and Deutsche Welle—all other things being equal. Yet, Radio Moscow's signal strength is generally about 10 decibels higher than the BBC's.

The more northern path of the Russian signal is important because the ionosphere in the auroral zone is frequently unstable. Northern lights, or auroras, are very common in that zone and adversely affect radio transmissions passing through the zone or close to it. During periods when the ionosphere is disturbed, the auroral zone moves south and signals that are normally stable are weakened. That is why transmissions from the BBC to North America, for example, "break up" before signals from Rome and Madrid. The paths of the latter signals lie farther to the south and those signals are therefore less prone to auroral effects even during ionospheric disturbances. But despite their more northerly path, Radio Moscow's signals remain strong even under adverse ionospheric conditions.

If SWL's (ShortWave Listeners) receive Radio Moscow signals about 10 dB more strongly than signals from the BBC, and if we consider that the BBC uses 250-kilowatt transmitters and high-gain curtain antennas that are located more than 1000 miles closer to America than those of Radio Moscow, then a few simple calculations would seem to lead us to the conclusion that the power output of the Radio Moscow transmitters is on the order of 32,000 kilowatts (32

megawatts) or more! But that is not the case, for—as far as is known—the most powerful transmitters the Russians use for international broadcasting have power outputs on the order of 500 kilowatts. What, then, are the Russians doing that is, in effect, giving them a power gain of over one hundred?

The mystery deepens if you listen carefully to Radio Moscow when it first comes on the air. Frequently the Russian signal will rise and fall in strength over a period of several minutes; that rise and fall is not related to normal fading of DX signals. After that, the signal level increases to a peak value and then remains very high for the remainder of the broadcast.

Backscatter

Scientists are becoming convinced that they have unraveled the mystery. Since the Soviets are apparently not using super-power transmitters, they must be doing something to their signals. The signal variation may be related to a technique called "backscattering". In addition, the Russians appear to be using antenna systems that are more sophisticated than anything currently available in the West.

The principle of backscatter has been known for a long time. Essentially, on returning to earth after being reflected by the ionosphere, a radio signal is scattered in all directions because of the irregularities in the earth's surface (see Fig. 2). A small fraction of the energy is returned to the transmitter site—having been "scattered" back in the direction from which it came. The strength of the

"backscatter" echo depends on the strength of the signal that struck the ground after reflection by the ionosphere.

It follows that if a wide range of frequencies is transmitted, some frequencies will penetrate the ionosphere and go into space, some will be absorbed, and some will be reflected. Backscattered signals will be received only for the frequencies that are reflected. Furthermore, the round-trip time delay of a very short pulse of radio energy is related to how far away from the transmitter the scattering took place; the longer the time delay, the farther away the signal was returned to earth.

A number of very useful facts can be obtained from an operational backscatter-system: We can determine the range of frequencies that the ionosphere is reflecting at any given time. From the strength of the backscatter signal we can learn which frequencies are strongest on reaching the earth from the ionosphere, and that tells us which frequencies the ionosphere is propagating best. From the time delay of the returned pulse and the characteristics of the transmitting-antenna pattern, we can also learn the height of the ionosphere from which the signals are being reflected. Using that information, it is possible to schedule frequencies that will deliver the best signals to a given target area. But, better still, that information makes it possible to determine the optimum radiation angles.

Suppose, for example, that in using conventional radio-forecasting techniques, the Russians have determined that at a particular hour the 7-MHz band should be optimum for transmission to the United States. The best radiation angle for that transmission will depend

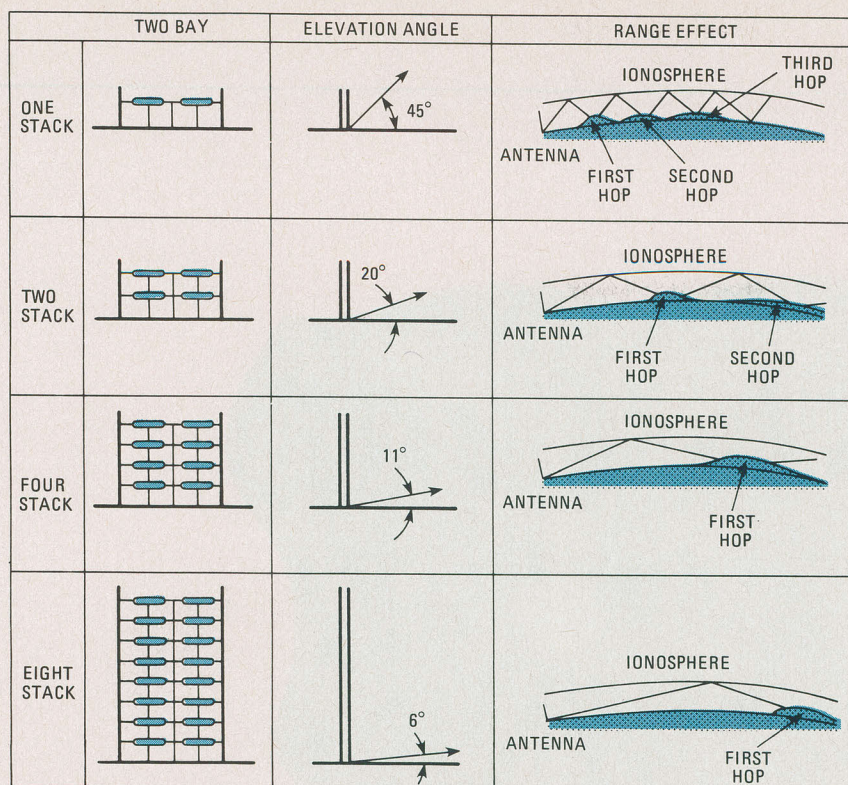


FIG. 3—THE MORE STACKS a curtain antenna has, the lower its angle of radiation will be.

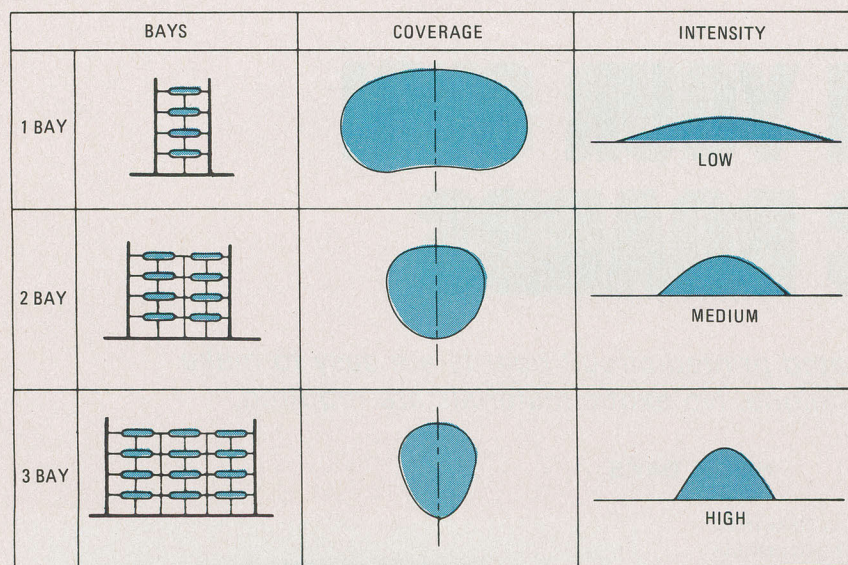


FIG. 4—THE WIDTH OF THE BEAM narrows, and the strength of the signal delivered to the target area increases, as the number of bays of a curtain antenna increases.

upon the height and state of the ionosphere at that time. A backscatter system that transmits very short pulses at various vertical angles could tell the broadcaster which radiation angle was returning the strongest signal, and consequently which angle would deliver the strongest signal. Appropriate adjustments in the vertical radiation angle of the antenna could then be made.

Antennas

The most sophisticated shortwave-

broadcasting antenna systems are known as *curtains*, consisting of arrays of dipole antennas erected in a plane and fed from a common source. The dipole antennas are arrayed both horizontally and vertically (one above the other). The number of dipoles erected vertically are called *stacks*, and the number horizontally are called *bays*.

As the number of stacks is increased, the vertical firing-angle narrows and becomes lower, concentrating more and more energy into a narrower beam as

shown in Fig. 3. As the number of bays is increased, the horizontal radiation pattern narrows, again concentrating the energy into a narrower beam as shown in Fig. 4.

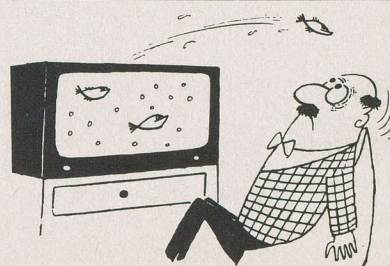
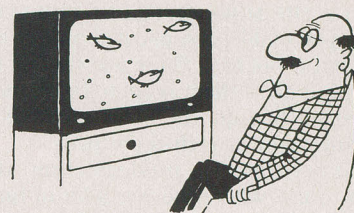
In the West, most curtain-antenna systems consist of four bays and four stacks. Such systems provide an antenna gain on the order of about 20 decibels. There is now considerable evidence to indicate that some Russian transmitting antennas, especially those used for long-distance broadcasting, consist of eight bays and eight stacks, giving an antenna gain of close to 30 decibels. Furthermore, curtain antennas can be slewed—that is, the vertical and horizontal angles at which the antenna radiates can be varied—by adjusting the phasing of the signals being fed to each bay and stack of the antenna.

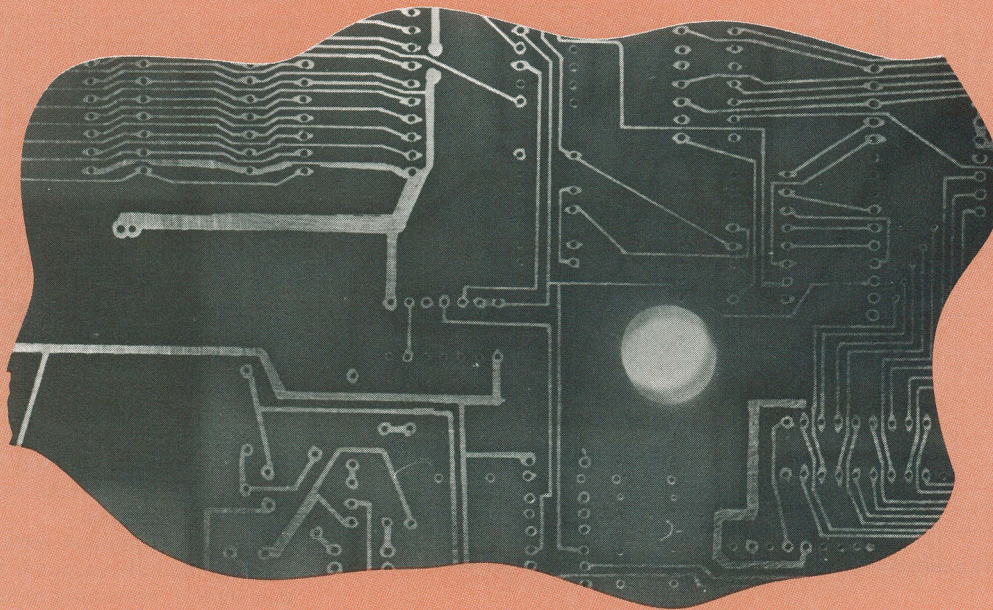
Experiments have shown that a gain of from 6 to 10 dB is possible if the ionosphere's height is properly used. Slewing is one way that the gain can be achieved. It would appear, therefore, that slewing, combined with a backscatter system, is the method used by the Russians to deliver such strong signals to the United States.

The use of optimum vertical radiation angles would also account for the Russian signals' remaining so strong during ionospheric disturbances. We have learned that during certain types of disturbances the ionosphere "tilts" and is no longer parallel to the earth's surface. Such tilts could affect optimum radiation angles, and backscattering for optimum angles would be invaluable.

The Russians tell us very little about their technical facilities, and we can only make some guesses from what we observe. But based on the strength of the signals from the BBC and Deutsche Welle using known antenna gains and transmitter powers, we must conclude that the Russians are using facilities and techniques that the United States will not be able to duplicate for at least three to five years.

R-E





ETCH YOUR OWN PC BOARDS

Even the most complicated printed-circuit boards are easy to make with this simple technique. No exotic materials are required.

NEIL R. DAVIS

ONE OF THE MORE DIFFICULT PROBLEMS YOU MAY RUN INTO when you build a complicated project is laying out and etching the circuit boards. There are several techniques that can be used, but all of them seem to have one drawback or another. For small boards, the usual methods include dry transfers, drafting tape, or etch-resist pens.

The dry transfers produce clean, sharp lines, but are difficult to use where there is a lot of fine work or where there are bends in the pattern. In addition, they don't always adhere properly throughout the etching process; you're likely to find the transfer floating in the bath while the foil disappears in the etching solution. The same problem occurs with narrow drafting tape, although the wider strips work reasonably well. Etch-resist pens are a good idea, but often don't protect the copper adequately.

Large boards, or microprocessor boards with complex buses, are difficult to make without using photographic techniques. Unfortunately, the photographic equipment and drafting aids needed make this technique somewhat impractical for the low-budget hobbyist.



FIG. 1—TINTED SHELLAC, a Rapidograph or similar drafting pen, a high-speed rotary drill, and drill bits are the only tools you need to make high-quality PC boards.

The easy way

The method described here uses a different etch-resist—ordinary shellac—that is laid down using a drafting pen such as the Koh-I-Noor *Rapidograph*, or similar pens made by Keuffel & Esser and Staedler-Mars. The tools that you'll need (including a PC-board drill) are shown in Fig. 1. The shellac should be tinted with a paint pigment (blue makes for good contrast) so that it is visible on the copper. Mix the shellac and the pigment thoroughly, and use the mixture undiluted.

To lay down a trace, simply draw a line on the copper, and go over it again if necessary, judging the thickness of the trace by the density of the pigment. For very fine work, it may help to dab the pen on the copper like a pogo stick to build up an even layer. Be careful that you don't leave an "empty" area in the center of a line.

What if you make a mistake? For smaller errors, scrape off the dried shellac with a small knife-blade, then clean the area with an ink eraser before redrawing. Larger mistakes can be removed easily with a cotton swab dipped in shellac thinner (methanol). Use the same solvent to clean the shellac off the board after etching, and to clean out the pen—it won't hurt



FIG. 2—DRAW YOUR PATTERN on a sheet of tracing paper that has been attached to a sheet of graph paper. The graph paper should have 0.1-inch spacing. For double-sided boards use a second sheet of tracing paper.

the plastic parts. As a matter of fact, the shellac can be left in the pen for several days or more without drying up or even getting gummy.

The technique is just as useful for small boards as it is for large ones. For small boards, simply copy the artwork from an article or draw your own on the copper. For larger boards, you will generally want to lay out your artwork on paper before working in shellac (see Fig. 2). The artwork can be done much more quickly if you use tracing paper or onionskin typing paper stapled or taped to a sheet of graph paper that has 0.1-inch spacing (the same spacing as IC pins).

For double-sided boards, add a second sheet of tracing paper for the traces on the other side of the board. As a general rule, put the most complicated traces (data bus, address bus, etc.) on the bottom side of the board, and use the top side of the board to "cross over" the traces on the bottom. Remember that the holes will not be plated through so allow for feedthrough jumpers where necessary. Use No. 28 or 30 wire-wrap wire for the jumpers and solder them on both sides of the board.

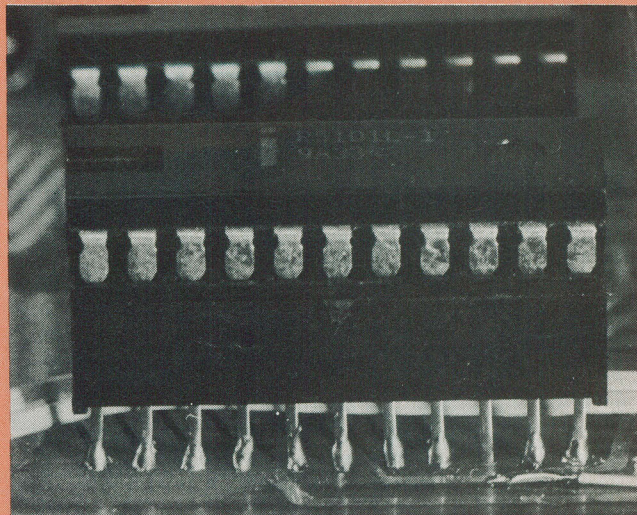


FIG. 3—SINCE THE HOLES ARE NOT PLATED THROUGH, wire-wrap sockets should be raised about $\frac{3}{16}$ inch off the board so that the pins can be soldered on both sides.

For complicated boards, it might be a good idea to use a hybrid wire-wrap/PC construction technique: Use the bottom side of the board for most of the circuitry; use the top side of the board for the power and ground, and wire-wrap sockets and wire-wrapping for the runs that won't fit on the board. The wire-wrap sockets should be raised approximately $\frac{3}{16}$ inch above the board to allow them to be soldered to both the top and bottom traces, as shown in Fig. 3.

Another approach for very complicated boards is to use both sides of the board for the circuit traces, and to hard-wire the ground and power lines later using jumpers. That is what was done in the board shown in Fig. 4: a microprocessor board with keyboard and display interface, a serial data interface, a total of 52 ports, and a battery-powered back-up memory.

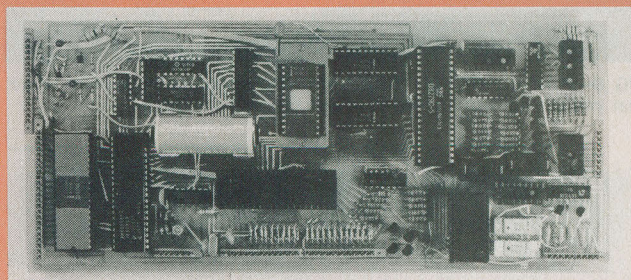


FIG. 4—THIS MICROPROCESSOR BOARD was built using the hybrid wire-wrap/PC construction discussed in the text. The board has a keyboard and display interface, a serial data interface, a total of 52 ports, and a battery-power memory back-up.

Step-by-step

The first step in making a board is drilling the holes. That is best done with a Dremel or similar high-speed rotary drill. Make a photocopy of your completed layout for use as a drilling guide, tape it to the board, and mark all of the holes with a center punch or scratch awl. For small boards, a piece of perforated construction board using 0.1-inch spacing makes an excellent drilling guide (see Fig. 5).

Use a No. 62 or No. 60 drill bit for resistor and capacitor

solder pads, and for IC solder pads where traces do not run between the pads; a No. 65 bit where the traces *do* run between the IC solder pads, and a No. 74 bit for feedthrough holes.

After you've finished drilling, clean off all the burrs with a fine file, sand the board thoroughly with No. 400 sandpaper, and then clean the board thoroughly by scrubbing the board with cleanser and water.

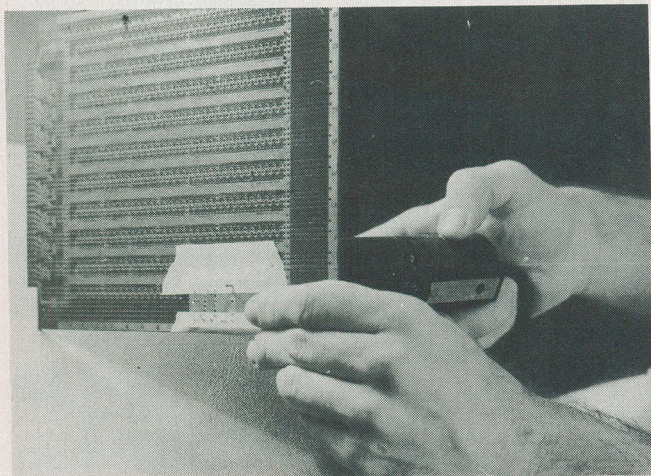


FIG. 5—WHEN DRILLING A SMALL BOARD, a piece of perforated construction board with 0.1-inch spacing makes an excellent drilling guide.

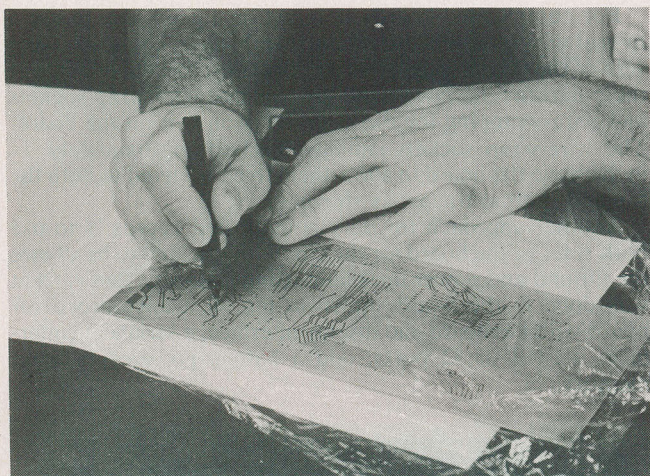
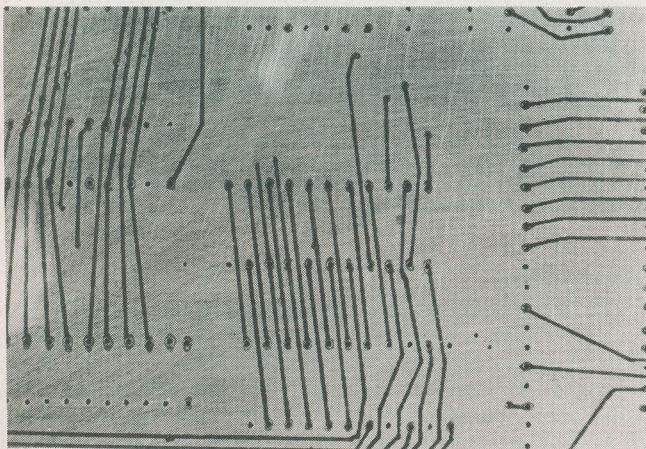


FIG. 6—PLASTIC KITCHEN WRAP is used to protect sections of the board that you are not working on from skin oils and smudging.



CLOSE-UP VIEW OF A PC BOARD under construction showing the shellac resist in place.

When that has been done, you can start drawing the pattern on the board. Complete one side of the board before starting the other, and begin by drawing the IC pads with the tinted shellac. Then, draw the larger traces using a drafting pen with a No. 2½ tip; use a No. 1 tip for traces that go between the IC solder pads and for labeling the board. Use a straightedge to guide the pen, and plan your work so that you will not have to lay the straightedge on wet shellac. Cover the portions of the board that you are not working on with plastic kitchen wrap, as shown in Fig. 6, to prevent contaminating the copper with skin oils and salts, and to keep

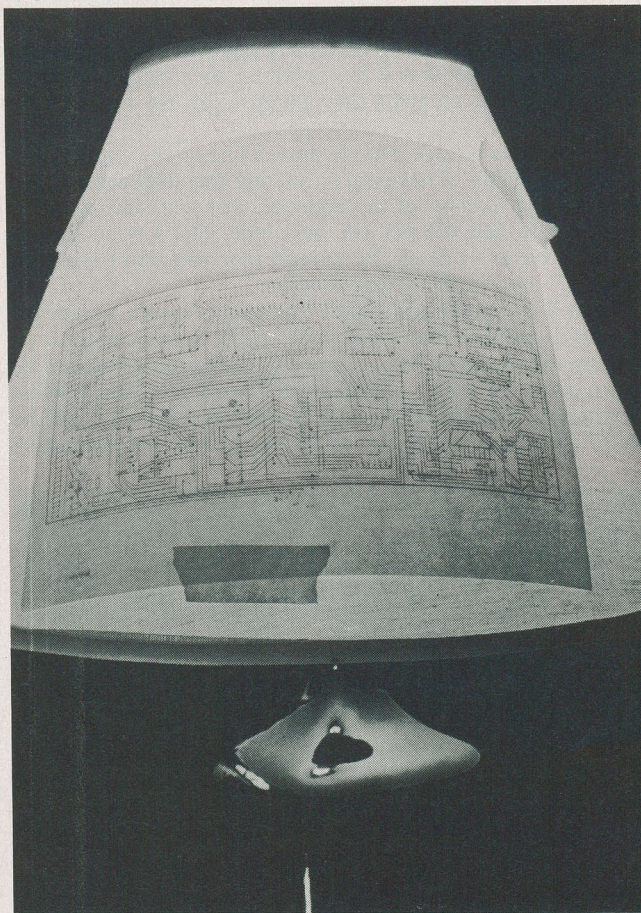


FIG. 7—TO OBTAIN A MIRROR image copy of a foil pattern, tape the art to a lampshade and trace it.

from smudging the board.

To draw the traces on the top side of the board, simply copy your artwork. For the bottom side of the board, you will have to turn your artwork over and hold it up to a light (taping the drawing to a lamp shade as shown in Fig. 7 is one approach that will make the job easier) before copying the artwork onto the copper.

After etching, clean the board thoroughly with methanol to remove the shellac. If you have followed the instructions, and have been careful, the result will be a clean and sharply-detailed foil pattern.

Be sure to solder all feedthrough jumpers on the top and bottom sides of the board before installing the sockets or IC's. Try to use sockets for the larger or more expensive IC's, or where you anticipate circuit changes. Soldering the IC leads is usually safe, but it is a good idea to use a temperature-controlled iron with a fine tip to avoid any damage resulting from excessive heat.

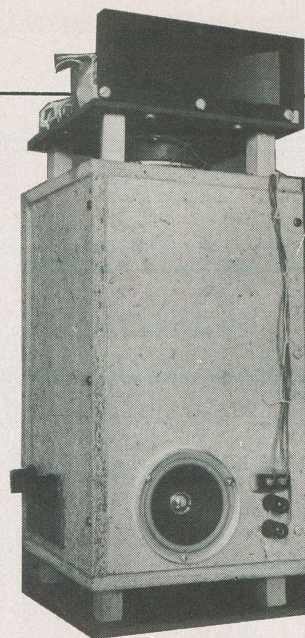
When the board is completed, clean off all solder residue with lacquer thinner or carburetor-cleaner spray. As a final step, coat the copper traces with a varnish or lacquer to prevent corrosion.

R-E

BUILD THIS

HI-FI MINI SPEAKER

The SAFE principle allows extended bass response from small speakers. Here's a 3-way mini-SAFE speaker you can build that's just 17 inches high; it will astound you with its performance and low cost.



GEORGE PAPPANIKOLAOU

ONE OF THE MANY PROBLEMS WITH MINI-SPEAKER SYSTEMS IS that it is difficult—if not downright impossible—to get full-size performance from them. (For example, it would be ludicrous to try to design a mini-Klipschorn!) By using acoustic-suspension techniques and special speakers, some manufacturers have managed to produce high-quality mini-speakers, although at a decrease in efficiency and an increase in price. Some people feel that there is no advantage to a mini-size speaker system that has to be used with a hefty amplifier.

There *is* an approach other than acoustic-suspension, however, that can be used for smaller speaker-systems. That is the SAFE (Symmetrical Air Friction Enclosure) configuration, covered by U.S. patent No. 4,168,761. Figure 1 illustrates the SAFE principles.

A SAFE speaker-system does not use a sealed enclosure, but, rather, makes use of both the front and back waves emanating from the woofer to provide clean, extended, bass response. The mid- and high-range radiators are conventional; the difference lies in how the bass is treated. The woofer is mounted near the top of the enclosure, facing downwards. The back wave propagates freely in all directions through the opening at the top of the enclosure. (Low-frequency sound is essentially non-directional to the ear—the idea is to generate as much of it as possible.)

The front wave from the woofer (represented by the dashed line) propagates along a path determined by a series of chambers formed by three centrally-located horizontal partitions and three other horizontal partitions with center holes (see Fig. 2). The wave is repeatedly split and recombined as it follows this path. That slows its speed, making it appear as if it had traveled a longer distance than the length of the path actually permitted. Upon reaching the center hole of the lowest partition, the back wave travels down the vertical port (tube) until it reaches the bottom plate of the enclosure and exits to the outside, again dispersed in all directions. The relatively long path (real and apparent) followed contributes to the low-frequency efficiency of the SAFE design.

Having already designed woofers and subwoofers using SAFE principles, I decided to try to use the same principles to build a three-way mini-size speaker that could be used by itself with a small amplifier, or with a subwoofer, to form a complete subwoofer-plus-satellite stereo-speaker system. While neither would be suitable for outdoor concerts, they

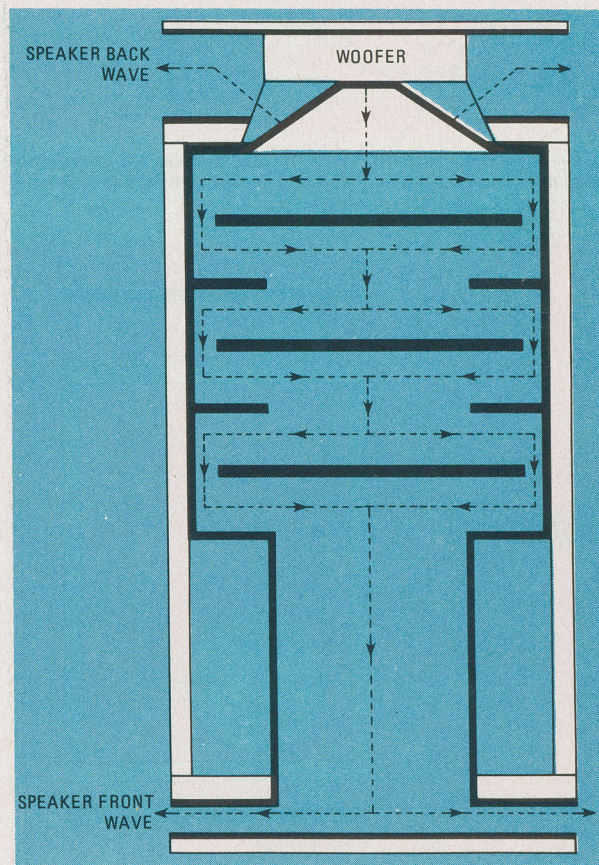


FIG. 1—SAFE EFFECT uses both the front and back waves from the woofer to extend bass response. The front wave travels through an acoustically long labyrinth to increase apparent size of enclosure.

would be more than adequate to fill the average-size listening room with sound.

Speaker selection

The 8-ohm speakers needed for the mini-SAFE system should be available from a number of sources: mail-order houses, audio outlets, and even car-stereo dealers.

The 5¼-inch woofer must be of the free-cone type—that

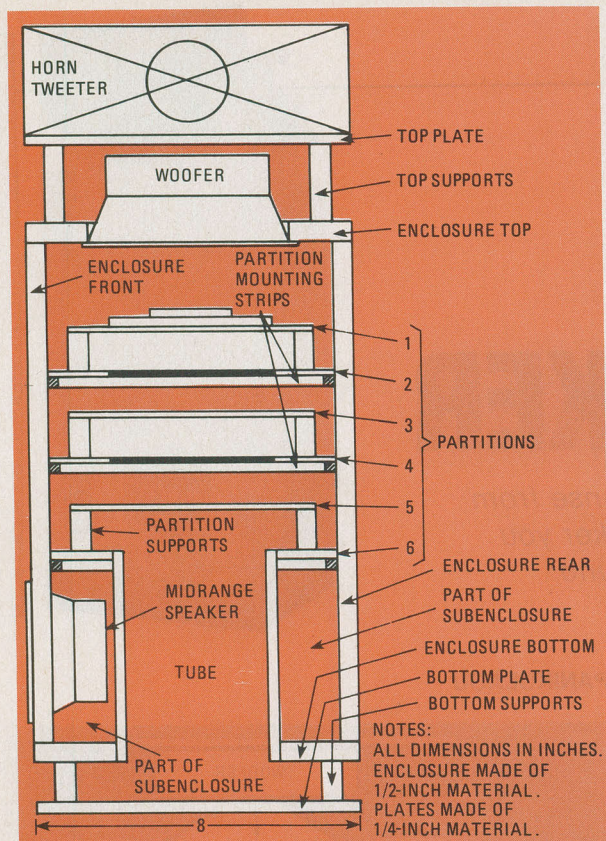


FIG. 2—LARGE HORN-TYPE TWEETER can be mounted above woofer. Sealed mid-range speaker is fitted into its own airtight sub-enclosure.

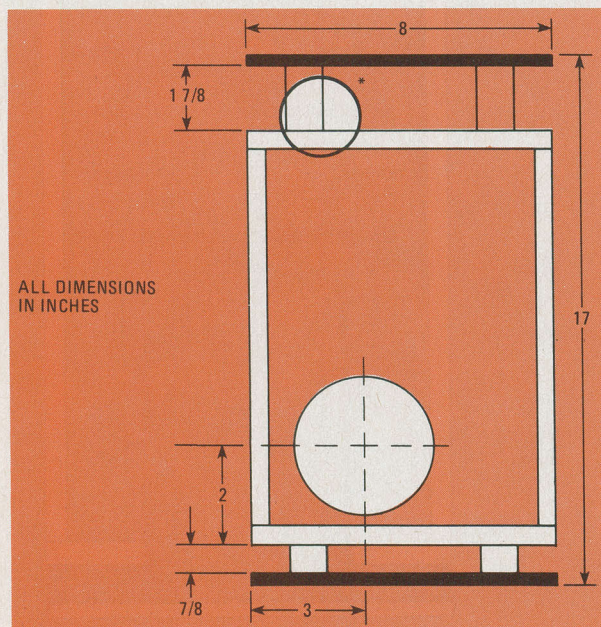


FIG. 3—POSITION OF CONE or dome-type tweeter is marked by asterisk. Note that both tweeter and mid-range speaker are mounted off-center—the latter to eliminate standing waves.

PARTS LIST—CROSSOVER NETWORK

- L1—620 turns No. 18 enameled wire one-inch core, three inches long.
- C1—2.2 μ F, non-polarized (1.0 μ F may be required if large horn-type tweeter is used)
- C2—47 μ F, non-polarized
- L-pads—standard, 8 ohms (Radio Shack 40-980 or similar)

PARTS LIST—ENCLOSURE

Quantity	Size (inches)	Description
2	8 × 8 × 1/4	Top and bottom plates
2	3 1/2 × 5 5/8 × 1/4	Part of tube
2	4 × 5 5/8 × 1/4	Part of tube
1	2 × 2 × 1/4	Part of partition-1 assembly
1	7 × 7 × 1/4	Partition 6 (with 4 × 4-inch hole for tube)
4	1 7/8 × 1 × 1	Top supports
4	7/8 × 1 × 1	Bottom supports
12	1 × 1 × 1	Partition supports
6	7 × 1/4 × 1/4	Mounts for partitions 2, 4, and 6
6	6 1/2 × 1/4 × 1/4	Mounts for partitions 2, 4, and 6
2	7 × 7 × 1/8	Partitions 2 and 4 (with 4 × 4 center holes)
3	6 × 6 × 1/8	Partitions 1, 3, and 5
2	8 × 12 3/4 × 1/2	Enclosure sides
2	7 × 12 3/4 × 1/2	Enclosure front and rear panels
1	4 × 4 × 1/2	Part of partition-1 assembly
2	8 × 8 × 1/2	Enclosure top with woofer mounting-hole and enclosure bottom with 4 × 4 center hole

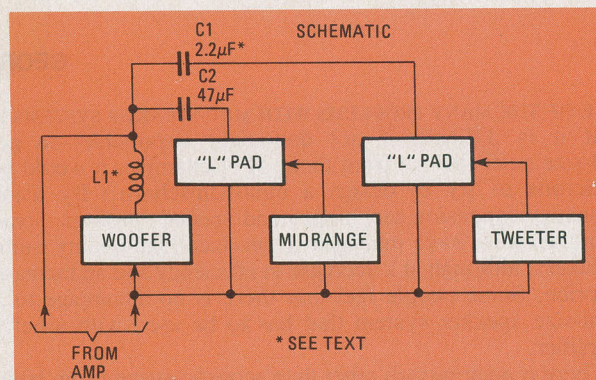


FIG. 4—SIX dB/OCTAVE crossover network is simple to build. L-pads balance sound from the three sections of the system.

is, the cone has to be able to radiate from both its front and back. A sealed acoustic-suspension type woofer is not suitable for use in a SAFE system. Woofers of the free-cone type are frequently found in car-stereo upgrade systems and can usually be purchased separately. A good heavy magnet is also essential—about 16-20 ounces.

A car-stereo outlet may also be able to provide the mid-range unit. It should be an acoustic-suspension type, about 3 3/4-inches in diameter with a 6-10 ounce magnet.

Both the woofer and mid-range units should be as shallow as possible, to fit into the small enclosure. If the woofer is too deep, it is possible to add some height to the cabinet, but the mid-range speaker is fairly critical in that respect.

The choice of a tweeter is not critical—it can be a high-efficiency cone or dome type, or even a relatively large horn mounted on top of the cabinet as shown in Fig. 2. A cone or dome-type tweeter should be mounted in the area indicated by an asterisk in Fig. 3. The tweeter is mounted to one side so that, if the mini-SAFE system is used in a horizontal position, the tweeter will be located higher than the mid-range speaker. (With a large horn, the positioning doesn't seem to make a difference.)

If desired, two systems can be made mirror-images of each other—that can improve the stereo effect, although, since the systems are so small, it may not be an important factor.

Crossover and L-pads

The mini-SAFE's crossover networks and L-pads are shown in Fig. 4. The L-pads are used to balance the system and also to optimize its bass response, which can vary depending on where in the listening room it's placed. (The bass

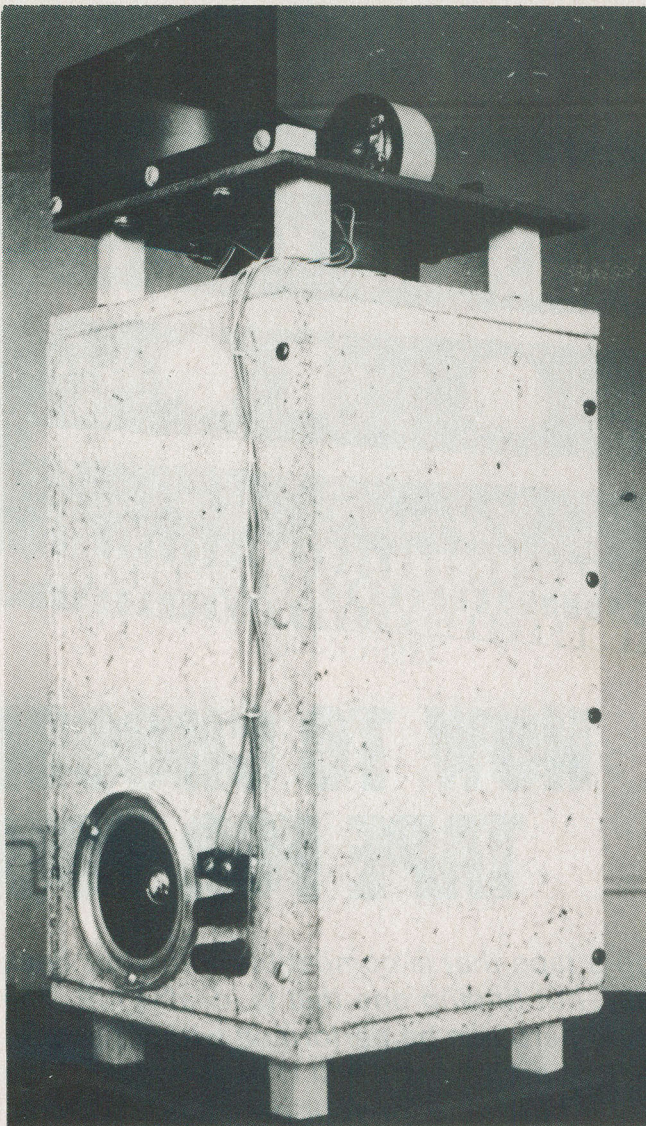


FIG. 5—CONNECTIONS FROM crossover network and L-pads are brought out through mid-range sub-enclosure. L-pads are on left side of enclosure.

PARTS LIST—SPEAKERS

Woofer: 5- or 5¼-inch woofer, 16-20 oz. magnet, open front and rear (not acoustic suspension) (Herald S-22 or equivalent)

Mid-range: 3¾- or 4-inch, 6½-10-oz. magnet, sealed (air-suspension) (Pioneer TS-107 or equivalent)

Tweeter: Cone, dome, or horn-type, high efficiency. Size not critical

will generally increase if the system is located near a room boundary and decrease as it is moved away from the walls and/or floor.)

The L-pads are standard 8-ohm units, available from a number of sources. It's important to make sure that they have adequate power-handling capacity. (The entire system is rated at 15-20 watts, maximum.)

The crossover networks are designed with a 6 dB/octave rolloff. The mid-range crossover network is designed to take effect at about 450 Hz; the high-frequency one has a crossover point of about 10 kHz. If a horn-type tweeter is used, the value of C1 should be changed from 2.2 μ F to 1.0 μ F. Coil L1 is made from 620 turns of No. 18 enameled wire wound on a one-inch core three inches long. Do not try to wind a shorter, thicker, coil—it may not fit into the space intended for it.

Figure 2 shows a sub-enclosure for the mid-range speaker.

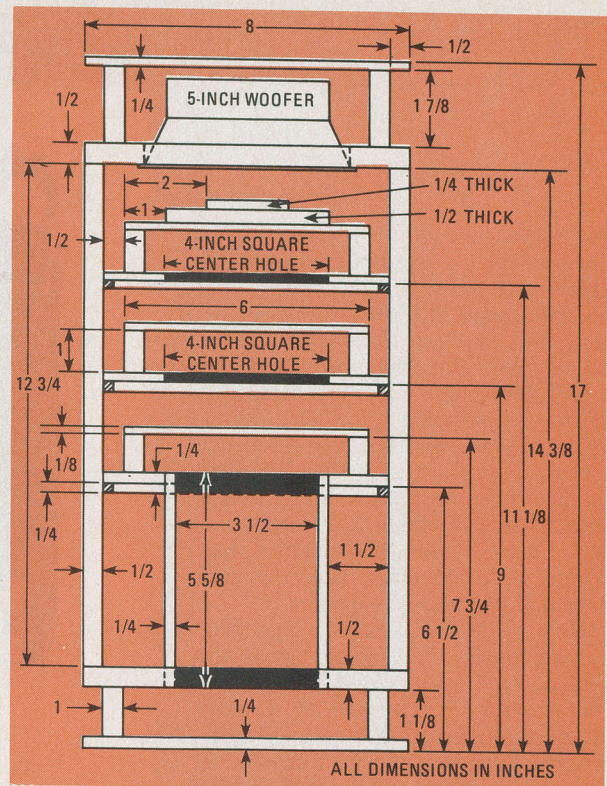


FIG. 6—CRITICAL DIMENSIONS for mini-SAFE enclosure. If woofer is deeper than one shown, top supports may be lengthened.

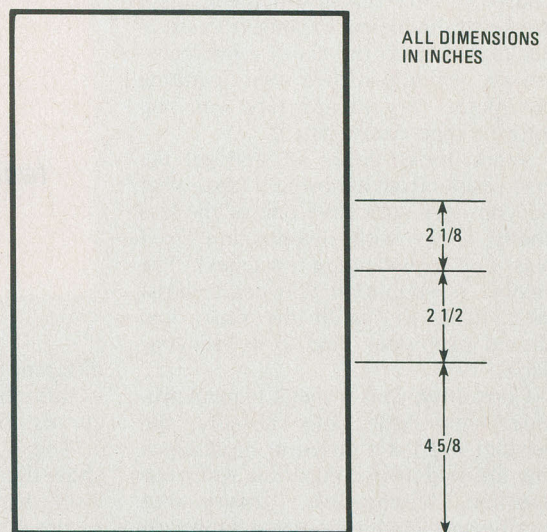


FIG. 7—INSIDE OF FRONT, BACK, AND SIDES should be marked as shown. Pieces should also be marked to indicate function ("FRONT," "L. SIDE," etc.).

That is where the L-pads and crossover networks are mounted. Wiring from them is brought out to terminals mounted on the front of the enclosure (see Fig. 5) to preserve its air-tightness. Wiring to the woofer and tweeter is run along the outside of the cabinet. The L-pads should be located on the side of the cabinet that will remain facing up if the speaker is to be used on its side instead of upright.

Construction

Refer to Figs. 2, 6, and 7, and to the Parts List, as we go through the assembly of the mini-SAFE system step-by-step. Before we start, here are a few helpful hints.

The flat parts (sides, top, bottom, and partitions) can be

continued on page 106

CHOOSING AN AUDIO CASSETTE-TAPE for your deck used to be a fairly simple affair—you went out and bought your favorite brand of ferric-oxide tape, because that was all that was available. Some years ago, things became a little more complicated with the introduction of chromium-dioxide tape. That formulation offered improved high-frequency response and a better signal-to-noise ratio, but required a much higher bias level than ferric-oxide tape. Soon, cassette decks with two-position bias switches to accommodate the two formulations began to appear.

Now, with the addition of cobalt-treated ferric and metal tapes, the simple two-position switch of a few years ago has given way to separate three- and four-position bias and equalization switches (yielding from nine to sixteen different combinations of bias and equalization), as well as continuously variable bias controls. And of course, if you can afford them, there are several new and expensive cassette decks that, with the aid of a microprocessor, will adjust their own operating parameters to suit any tape you pop into the tape compartment.

While those decks let you get the best results from almost any tape, what do you do if you have one of the less costly decks with two-position fixed bias and equalization switches? The answer is simple: If you can't adjust your deck to match the tape, you should pick your tape to match your deck.

Consulting your owner's manual provides very little help. Usually, the booklet will list a dozen or more tapes that are said to be compatible with your machine. Compatible, maybe—but hardly ever ideal, unless you happen to know which brand of tape was used by the manufacturer in calibrating your machine when it left the production line. To make matters worse, manufacturers of cassette tape have a habit of changing or improving their tape formulations without necessarily changing the model number or trade name of the tape. As a result, the type of tape that worked ideally with your cassette deck when it was new may no longer be the best tape to use with that machine.

Frequency response

The specification that is of greatest concern to most amateur recordists is the record/playback frequency response. Even among the so-called premium tapes of the same formulation,

different brands of tape will yield widely different overall frequency-response curves. That is clearly shown in Figs. 1, 2, and 3; the graphs in those figures show the frequency-response curves of three high-quality ferric-oxide tapes. Figure 1 shows the record/playback response, at a recording level of -20 dB (with respect to a reference 0 dB of 200 nanowebers/meter) for TDK *OD* tape, while Fig. 2 shows overall record/playback response for Maxell *XL-IS* tape tested on the same machine at the same record level.

Finally, in Fig. 3 we see the record/playback response for Fuji *FX-I* tape. All of those tapes were tested under identical conditions on a Nakamichi model 680ZX cassette deck—hardly a bottom-of-the-line model. Yet, rather significant differences in high-end response are obvious from the curves. If the user wants flat, extended high-end response, the tape to choose (from among those tested) is obviously the Maxell *XL-IS* tape, with its $+1.8$ -dB

output at 20 kHz. TDK *OD* ran a close second on our test machine, with an output that is up 1.1 dB at 20 kHz, while the Fuji *FX-I*, though by no means an inferior tape, delivered a -0.3 dB output at 20 kHz when used with that machine.

In Figs. 1, 2, and 3, we deliberately expanded the vertical scale so that each division is equal to only 2.0 dB. That

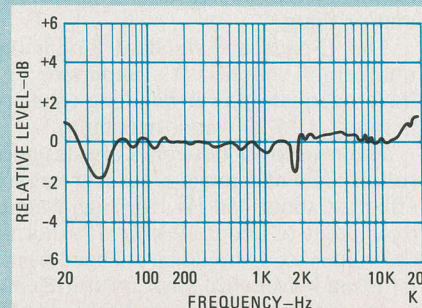


FIG. 1—OVERALL FREQUENCY RESPONSE CURVE for TDK type *OD* tape. That response curve was obtained at a recording level of -20 dB.



HOW TO CHOOSE TAPE FOR YOUR

Finding a tape that is compatible with your deck is easy, but finding one that is ideal is not. The tests described here can be performed without expensive test equipment and will lead you toward the best tape for your particular machine.



THE BEST CASSETTE DECK

LEN FELDMAN

CONTRIBUTING HI-FI EDITOR

was done so that it would be easy to distinguish small differences in output at specific frequencies. But what about the average hobbyist who does not own or have access to expensive frequency-response plotting equipment found in hi-fi labs?

The answer is: Even without test equipment of that sort, it is quite simple to judge differences in overall tonal balance or frequency response. One

easy method involves the use of an FM tuner. When an FM tuner is tuned between stations (with the muting circuitry deliberately turned off), what you hear has been described as random white noise. It isn't white noise; it's white noise *modified* by the de-emphasis network built into your tuner. That network attenuates frequencies above 1 kHz or so to compensate for the same amount of high-frequency boost intro-

duced at the broadcasting end of the chain. In any event, that random noise signal can serve as an excellent test signal with which to evaluate the frequency response characteristics of a tape recorder.

In checking the response of two-head recorders, it is first necessary to record a reasonably long amount of FM-tuner noise onto the tape in question. Make that recording at about a -20 dB record level (as indicated on your recorder's VU meters or other level indicators). Since it is not possible to monitor the results instantly from the tape, rewind the tape to the beginning and start playing it back, alternating between the original random-noise source (with the monitor switch on your receiver or amplifier set to source) and the recorder version of the same noise (with the monitor switch set to "tape").

In making that test, it is extremely important that the two loudness levels be identical. It is not enough to verify that "by ear." Rather, you should attach a wideband AC voltmeter to the output terminals of your amplifier (or the speaker-output terminals of your receiver) and adjust levels so that the meter reads an identical value when switching from "source" to "tape" on your tape monitor switch. If you do not have access to a wideband voltmeter (such a meter has a frequency range of 20 Hz to 20 kHz), you can rectify the output from your amplifier (using a full-wave bridge), and feed the resulting signal to a standard voltmeter. While that will not yield an exact voltage reading, you will be able to compare and match the relative levels using the meter's DC scale. Since the amplifier or receiver is likely to have only one volume control, use it to control the original random-noise level from the tuner section. Use the output control on your tape deck to obtain the identical level of output when listening to the tape playback of the noise.

Using that method, even *small* tonal differences are easily detectable. Some practice may be required before you can pinpoint just what the sonic differences (where the peaks and valleys) are, but it takes little or no practice to determine accurately which of several tape samples comes closest in overall tonal balance to the original sound. To verify that, we took a spectrum-analysis photo of our reference noise signal (Fig. 4) and compared it with the recorded results obtained from two different tapes (Figs. 5 and 6). Superficially all three noise spectrum photos seem to

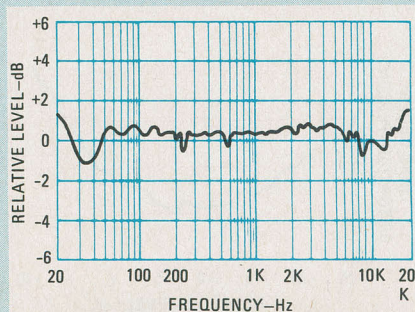


FIG. 2—FREQUENCY RESPONSE of Maxell XLI-S tape.

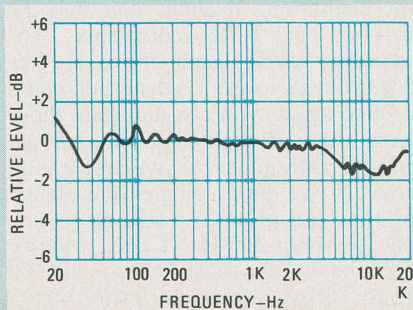


FIG. 3—FREQUENCY RESPONSE OF Fuji FX-1 tape.

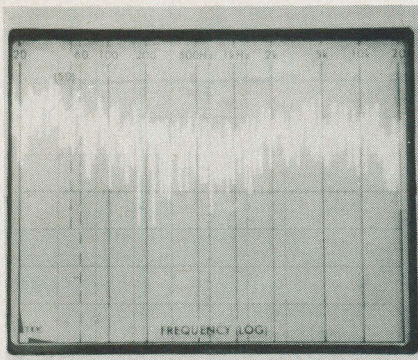


FIG. 4—SPECTRUM ANALYSIS of a reference noise signal.

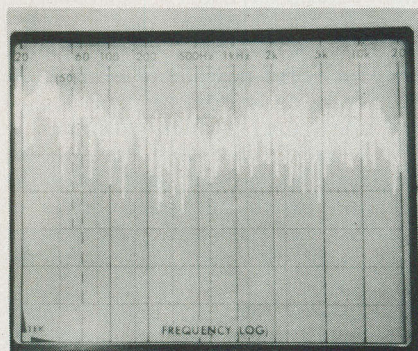


FIG. 5—THE REFERENCE NOISE was recorded on the Maxell tape, and a spectrum analysis was made of the result. That analysis is shown here.

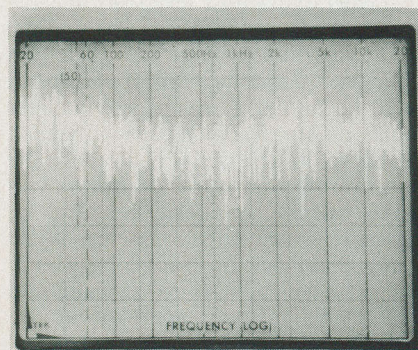


FIG. 6—ALTHOUGH THE SPECTRUM ANALYSIS of the Fuji tape superficially appears similar to those shown in Figs. 4 and 5, the recorded signal sounded less like the original than did the Maxell tape.

be about the same; yet, when we listened to the tapes, the Maxell *XL-1S* tape (whose noise spectrum is shown in the photo of Fig. 5) sounded more like the original noise that did the competing tape of Fig. 6.

The procedure used for three-head tape decks is considerably simpler and faster. Here, it is only necessary to flip the source/tape switch on the deck itself from one setting to the other, listening alternately to the source noise-signal, and then to the recorded version of it.

In making those tests on a three-head machine that uses separate heads (as

opposed to the machine where the record and playback heads are in a single housing), it is important to check the azimuth alignment between the record head and the playback head. Most three-head machines provide a simple means for making that check and for adjusting the azimuth if it is not perfect. Incorrect azimuth alignment, of course, will result in severe attenuation of high frequencies, which might be incorrectly attributed to the tape or tapes under test.

Distortion

If a tape is slightly underbiased or overbiased, the most profound effect observed is a change in overall frequency response. However, non-optimized bias levels have an effect upon distortion, as well. Almost any tape can be made to have "flat" response if you lower bias levels without regard to distortion at mid-frequencies. Referring back to Figs. 1, 2, and 3, third-harmonic distortion for each of the three tapes tested is as follows: Maxell *XL-1S*, 0.5%; TDK *OD* and Fuji *FX-1*, 0.29%. Note that while the third-harmonic distortion for the Maxell tape is nearly twice as high as the others, it provided the highest output of 20 kHz of all the tapes tested. All three tapes have reasonably low distortion at the 0-dB record level (the level at which those third-order distortion levels are measured), since even 0.5% distortion is inaudible to most listeners. What *does* make an important difference in choosing the right tape for your machine is the so-called headroom, or the maximum record level, that can be applied to the tape before reaching 3% third-order distortion.

Figures 7, 8, and 9 plot third-order distortion (vertical axis) against recording level (horizontal axis). Surprisingly, the Maxell *XL-1S* tape had the greatest headroom (+9 dB for 3.1% third-order distortion) of all three tapes tested. The results are shown in Fig. 7, while those for the Fuji *FX-1* tape (+8 dB for 3.1% third-order distortion) are shown in Fig. 8; and the TDK *OD* tape (+7 dB for 2.6% third-order distortion) is in Fig. 9. One note about the test equipment used to obtain those results: While it is very accurate, it does have one limitation—readings can only be obtained at 1-dB increments. The recording levels listed above are the closest levels to the 3%-distortion point.

Once again, you can duplicate those tests, although with somewhat less accuracy, without expensive test equipment. If you have a single-tone oscillator that can produce a mid-frequency tone of about 400 Hz (1 kHz will also work, as will anything from around 300 Hz to 1 kHz) and an AC meter with a dB scale, then all you need to do is to record progressively greater signal

levels onto the tape that you are testing.

If you do not have a single-tone oscillator, the simple circuit shown in Fig. 10 will serve. The circuit will generate some distortion itself; but since we are interested in which tape is best, and not the headroom for precisely 3% third-order distortion, that distortion will not affect the result. Also, the output of that circuit is adjustable down to 1 volt, using the potentiometer. Verify, with a meter, that the output is indeed 1 volt before you connect it to your tape-deck's input.

If your meter does not have a dB scale, you can use Table 1 to convert the voltage reading on your meter to dB. To establish the voltage ratios, use the "0-dB" point on your tape deck's meters as a reference. Note the reading on your externally connected AC meter, and then increase the signal level in 1-dB steps until you are at a record level of 10 dB, or even a bit higher. You need the external meter, because most tape-deck VU meters read only to about +3 dB, or at most +5 dB, whereas the recording head-

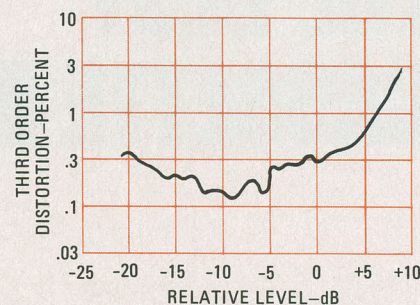


FIG. 7—THIRD-ORDER DISTORTION for TDK type *OD* tape is plotted against recording level here.

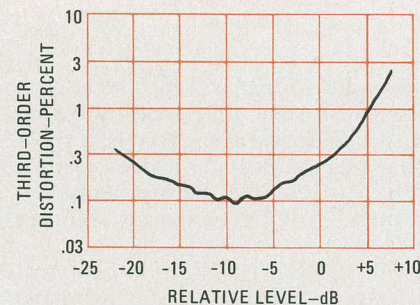


FIG. 8—THIRD-ORDER DISTORTION for Maxell type *XL1S* tape.

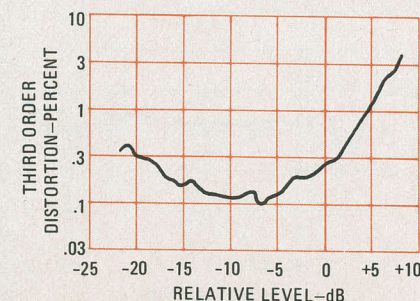


FIG. 9—THIRD-ORDER DISTORTION for Fuji type *FX-1* tape.

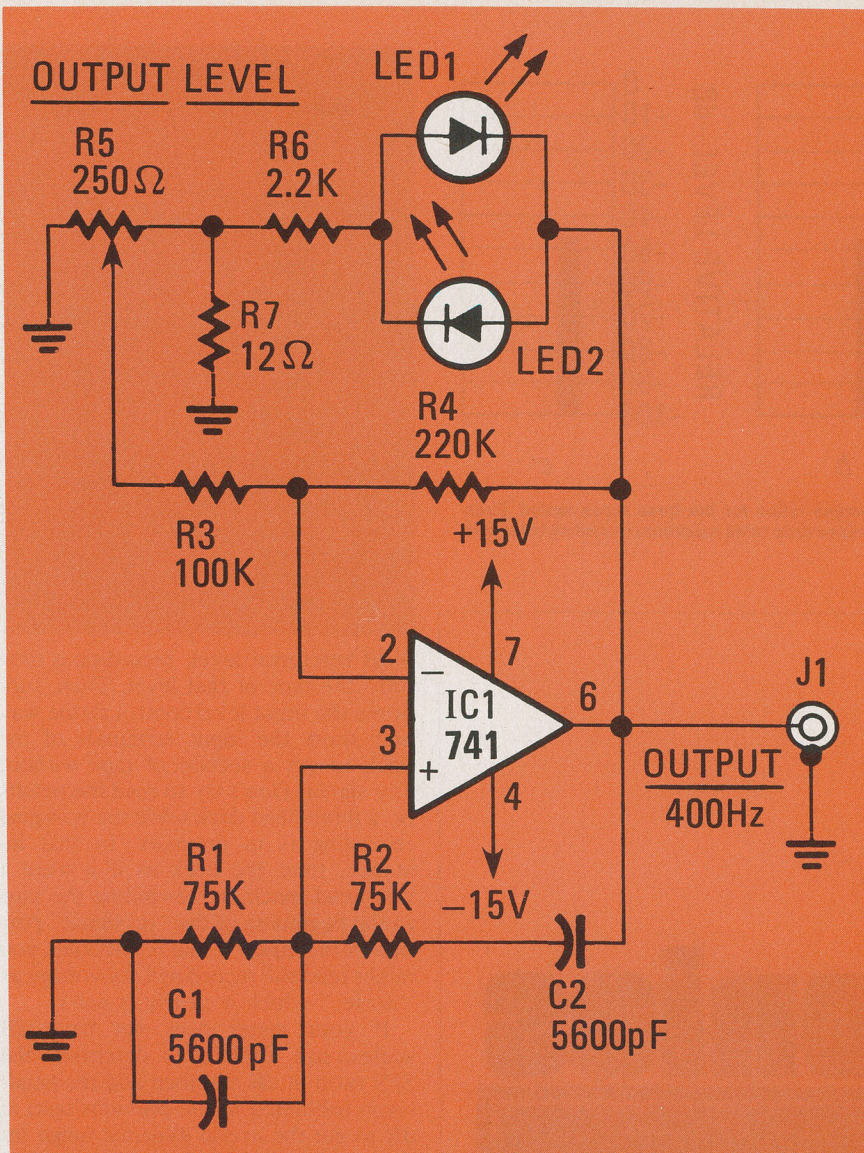


FIG. 10—USE THIS CIRCUIT if you do not have a single-tone oscillator. Make sure to adjust the output to 1 volt before connecting it to your tape deck's inputs.

room for the tapes you are testing may well be above that. Don't be concerned if you peg the needles on your tape deck's meters—the meters won't be destroyed.

Once again: In the case of two-head machines, you will have to rewind the tape and play back the recording. Count the successive steps above 0 dB as you hear them. At some point, you will hear a clear indication or rising distortion (the presence of 3% or more of third-order distortion will be obvious). Record the number of dB above 0-dB reference where this occurs, and go on to the next tape.

In the case of three-head machines, as before, you can increase recording level in 1-dB increments and listen to the recorded results as you go, comparing the purity of tone of the source signal with the tonal mix of the recorded signal. You will probably detect a change well before you reach 3% third-order distortion, but again, since you are interested in finding out which tape is "best," and not the relative head-

TABLE 1	
Voltage ratio	+dB
1.000	0
1.122	1
1.259	2
1.413	3
1.585	4
1.778	5
1.995	6
2.239	7
2.512	8
2.818	9
3.162	10
3.548	11

room for precisely 3% distortion, it doesn't matter where you stop the test, so long as you stop at the same level of perceived distortion for each tape.

Dynamic range

Having established the maximum recording levels of each tape for your tape deck, you will want to find out their dynamic range. The dynamic-range capability of any tape is the difference,

PARTS LIST—400 Hz TONE GENERATOR

Resistors, ¼ watt, 5%, unless otherwise noted

R1, R2—75,000 ohms
R3—100,000 ohms
R4—220,000 ohms
R5—250 ohms, potentiometer
R6—2200 ohms
R7—12 ohms

Capacitors

C1, C2—5600 pF

Semiconductors

IC1—741 op amp
LED1, LED2—jumbo red LED
J1—phono jack

Miscellaneous: wire, solder, etc.

in dB, between the maximum recording-level and the signal-to-noise ratio (in negative dB) for that tape. For example, if a given tape has +8 dB headroom at mid-frequencies and a signal-to-noise ratio of -45 dB (below the 0-dB reference), then the useful dynamic range for that tape, at least at mid-frequencies, is 53 dB.

In the case of our three tapes, the signal-to-noise ratios are shown in the bar graphs of Figs. 11-a (Fuji *FX-1*), 11-b (Maxell *XL-1S*), and 11-c (TDK *OD*). Adding the 8 dB of headroom previously observed for the Fuji tape to its 48.4 dB S/N ratio, we get a dynamic-range capability of 56.4 dB. For the Maxell tape it is 45.8 dB plus 9 dB of headroom, or 54.8 dB, while for the TDK tape it is 46.5 dB plus 7.5 dB, or 54.00 dB. (As mentioned above, the maximum recording-level for the TDK tape was set at the 2.6% third-order distortion level, while the maximum recording-level for the other two tapes in this test was set by the 3.1% level. Because of that difference, an extra ½-dB was added to the headroom of the TDK tape to make our comparison fairer.) Thus, the Fuji tape wins out in this parameter for *this tape deck*.

Again, you can measure S/N ratios easily, using nothing more than the mid-frequency tone generator (or the circuit shown in Fig. 10) and the AC voltmeter as before. Here however, it is important that the AC meter be sensitive enough to read the low voltage levels of the residual noise that is present during tape playback. If the nominal output level from your deck is 1.0 volt (a typical figure) when playing back a signal recorded at the 0-dB reference level, then your AC meter should be able to read down to levels of 1.0 millivolt, or lower (1 mV is 60 dB lower than 1 volt), especially if you hope to read the S/N ratio with the noise-reduction circuits turned on. Note that the signal-to-noise ratios we obtained in Fig. 11 were obtained without the benefit of any noise reduction.

To make the tests, first establish the

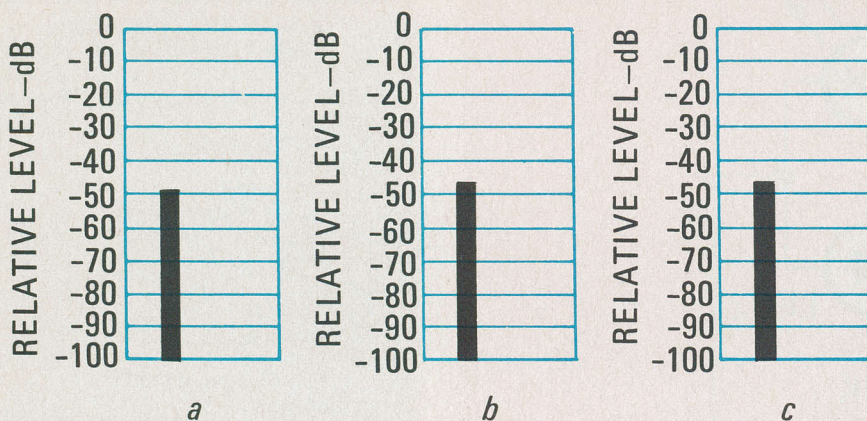


FIG. 11—THESE BAR GRAPHS SHOW the signal-to-noise ratios for the three tapes tested. Each tape's dynamic range is found by adding its signal-to-noise ratio to its maximum recording level (see Fig. 5).

Voltage ratio	-dB
.01	40
.00891	41
.00794	42
.00708	43
.00631	44
.00562	45
.00501	46
.00447	47
.00398	48
.00355	49
.00316	50
.00282	51
.00251	52
.00224	53
.002	54
.00179	55
.00158	56
.00141	57
.00126	58
.00112	59
.001	60

0-dB reference level, recording a tone onto the tape at that level. Then, turn down the input level control all the way and short the input terminals of the deck to get a section of tape without any signal. Don't try to read the results on a three-head deck while the no-signal recording is in progress. In that instance, treat the deck as if it were a two-head machine, rewinding the tape to the beginning of the "no signal" portion of the tape. (If that is not done, you might read the recording bias-voltage as "noise," which it clearly is *not*.)

If your meter does not have dB scales, use Table 2 to determine the S/N ratio in dB and then add the headroom (obtained in the previous test) in dB to get the useful dynamic range for the tapes being tested. That method does not take into account any "weighting curves" (CCIR/ARM weighting was used to obtain the results shown in Fig. 11) but that is not a serious shortcoming because we are only interested in relative signal-to-noise ratios, so that we can establish which tape is best for a particular machine.

Some mid- to high-priced cassette decks offer continuously variable bias adjustments in addition to the bias settings provided by a three- or four-position switch. If you own such a machine, you can use the same measurement techniques to establish the precise bias levels for the tape of your choice, instead of making the measurement on several tapes to establish which brand and type is best for your requirements. Remember, however, that a change of bias affects *all* of the parameters that we have discussed; so if you change bias to obtain a more uniform frequency response, be sure to recheck distortion, headroom, and the signal-to-noise ratio. Then you can arrive at the best compromise bias setting for your tape and machine. **R-E**

Announcing Radio- Electronics

Video Entertainment '82
...A Special
Editorial Supplement
in the
January 1982 Issue:

Available on Newsstands everywhere
December 17,
Reserve Your Copy Now, This issue
Will be a SELLOUT!

To obtain the best possible performance from your color TV set, the color video stages must be properly aligned. Here are step-by-step procedures on how to do that alignment using a scope and a sweep/marker generator.

Do it yourself COLOR ALIGNMENT

JACK DARR
SERVICE EDITOR

IN COLOR TV SETS, THERE IS A VERY important stage that must be aligned—the color bandpass and color takeoff. In that stage, there are only two coils: a single-tuned coil in the input (the color takeoff) and a double-tuned transformer (the color bandpass), which is really only a 3.5-MHz IF transformer!

This is the circuit that amplifies the color signals after they have been picked off in the video detector. In that stage, the signals beat against the 45.75-MHz picture carrier and emerge at their original frequencies of between 3.08 and 4.08 MHz.

Actually, this is a group of sideband signals of the 3.58-MHz color carrier, all of which must be passed or the color will be wrong. That requires the proper bandpass transformer. All sets have at least one—you may find some that have two bandpass transformers. It makes no difference, any more than in an AM radio with two or three IF stages—the alignment is similar.

A hill from two slopes

You want only the color signals. So to obtain them from the confusion of assorted frequencies at the output of the video detector, just hook up a simple tuned transformer that passes only the desired signals. (It's the same as the process used to pick off the IF in a radio mixer!)

But there's one problem: The color band-limit signals in the IF are *not* at equal amplitudes. That is because

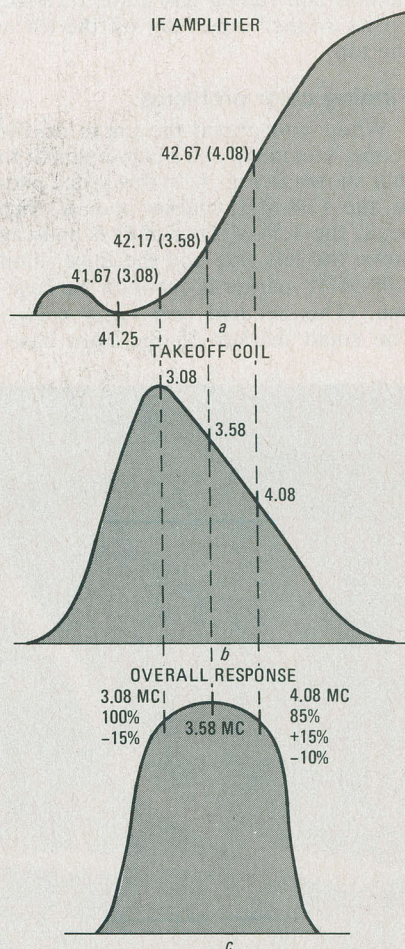


FIG. 1—A COLOR BANDPASS CURVE. Two opposite-slope responses—IF and color takeoff coil—give the needed "haystack curve."

they're on the color slope of the IF curve. A frequency of 4.08 MHz is much higher than one of 3.08 MHz. How do you get a nice symmetrical, flat-topped hump-shaped curve out of that?

Easy. You deliberately cause the color takeoff coil to have an equal but *opposite* slope. Figure 1 shows how that is done. Figure 1-a shows the response of the IF, and Fig. 1-b shows the response of the takeoff coil. In this, the 4.08-MHz frequency is low on the curve, while the 3.08-MHz frequency is high on the response curve. When you add the two responses together you get a nice symmetrical hump (see Fig. 1-c), that is fed into the double-tuned bandpass transformer. The output of that signal will also be a haystack or a hump.

As you can see, the alignment of this stage *must* be right to avoid unequal amplification of the color sidebands. There are several ways of obtaining a suitable test signal.

One way is to feed in a swept signal, centered at 3.58-MHz, with 3.08-MHz and 4.08-MHz markers. That signal can be fed *into* the video detector at the same point at which the output was removed for IF alignment. From here, the signal passes through the video-amplifier stages, and is taken off and fed to the color stages just as a real TV signal is. Figure 2 shows that hookup.

To observe the output curve, connect the scope to the output of the bandpass amplifier. It is connected to

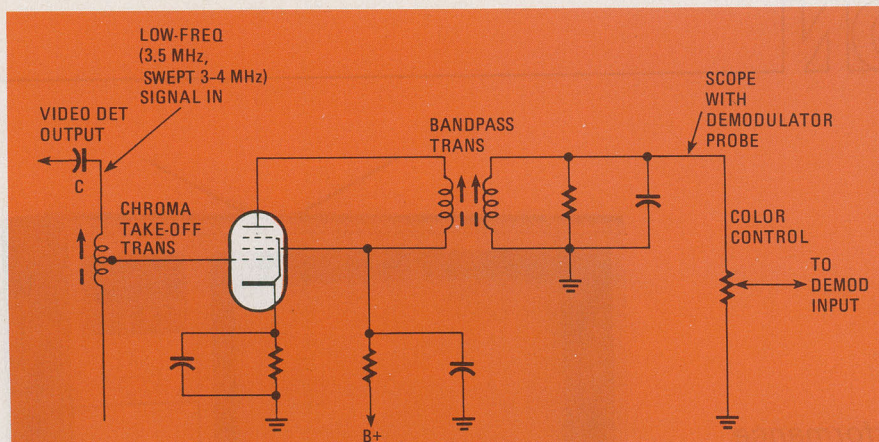


FIG. 2—THE SWEEP GENERATOR AND SCOPE connections for aligning color bandpass stages.

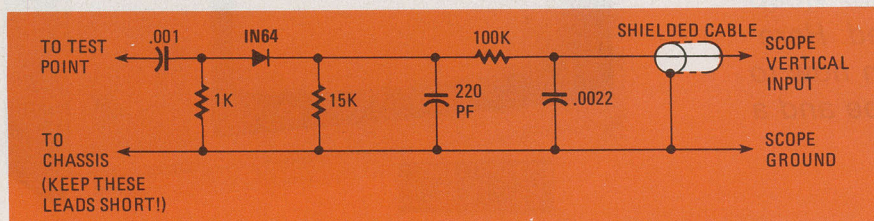


FIG. 3—CRYSTAL DETECTOR PROBE you can build yourself for use with any scope.

the grids of the color demodulators. (In quite a few sets, this is the color control itself, an easy point to locate.)

At this point (and all the way through, in fact) these signals are RF signals. So you must use a demodulator probe on the scope to see a curve. If your scope doesn't have a probe, you can build one. Figure 3 shows a simple version that can be constructed on a small piece of perfboard, with a 50-ohm cable leading to the scope. (Note—practically all new sweep generators provide a demodulator probe just for this job.)

Video sweep modulation

The other way to obtain the bandpass signal curve is to use video sweep modulation (also called *Chroma Sweep Modulation* in one TV set). You feed a sweep signal into the mixer test point, but this time you add a 45.75-MHz picture carrier signal to it. Also, you use IF color markers at 42.67, 42.17 and 41.67 MHz. In the video detector of the TV set, those frequencies beat together to result in a +3.58 MHz sideband signal just the same as with a TV signal.

No matter which method you use, the signal at the bandpass-output will be the same haystack curve with band-limit markers. The 3.58-MHz marker must be in the center of the curve, and the two band-limit markers should be on the shoulders of the curve, as shown in Fig. 1-c. The curve should be symmetrical. Incidentally, although you *can* hook up the scope and observe the unbalanced curve of the color-takeoff coil, you usually won't have to. If you can see the *overall* response curve, you can adjust all three tuning adjust-

ments to obtain the desired shape. The bandpass transformer tuning affects the height and shape of the curve; the takeoff-coil tuning has quite an effect on its *shape*, especially on the tilt at the top.

Finding color problems

When you obtain the curve on the scope, you might see a curve similar to that shown in Fig. 4. In this scope photo, the 4.08-MHz marker is on a sharp peak, the 3.58-MHz marker is halfway down the left side and the lower-limit 3.08-MHz marker is down on the baseline. (This set had *very* fuzzy color!) The small marker on the right base-

line is a 4.5-MHz marker that can be used, although it isn't necessary.

In general, you can do something like this: Peak the bandpass coils to obtain some kind of curve, and then adjust the color takeoff coil and bandpass tuning to observe the correct curve shape. Figure 5 shows the results. The two markers on the shoulders of the curve are the band limits. In Fig. 5, the 3.58-MHz marker has been turned off. The small pip in the middle is from the TV set's 3.58-MHz oscillator. You can almost always use it; the generator's 3.58-MHz marker sometimes beats with it, causing a slight smear.

Here, too, you may have to go back over the adjustments several times since they interact quite a bit.

Sound trap adjustment

One more trap needs to be checked—a 4.5-MHz trap, usually in the input or output of the first video amplifier stage. Its purpose is to keep the 4.5-MHz sound IF signal from passing through the video stages to the screen. If it does, it makes a fine-line beat signal in the picture.

To set that, connect your cable to the marker output of the sweep generator. Feed its output directly into the set's video-detector output. Connect your scope to the video amplifier plate, grid, etc., at a point *past* this trap. Turn on the 400-Hz or 1000-Hz modulation of the sweep generator. It will be detected and appear on the scope as an audio signal (see Fig. 6). (If you want to, you can feed this signal into the input of the last video IF stage; sometimes that gives better results.)

Now, locate the 4.5-MHz trap, and simply adjust it for *minimum* audio signal, as shown on the scope. If the trap is set exactly right, you may not

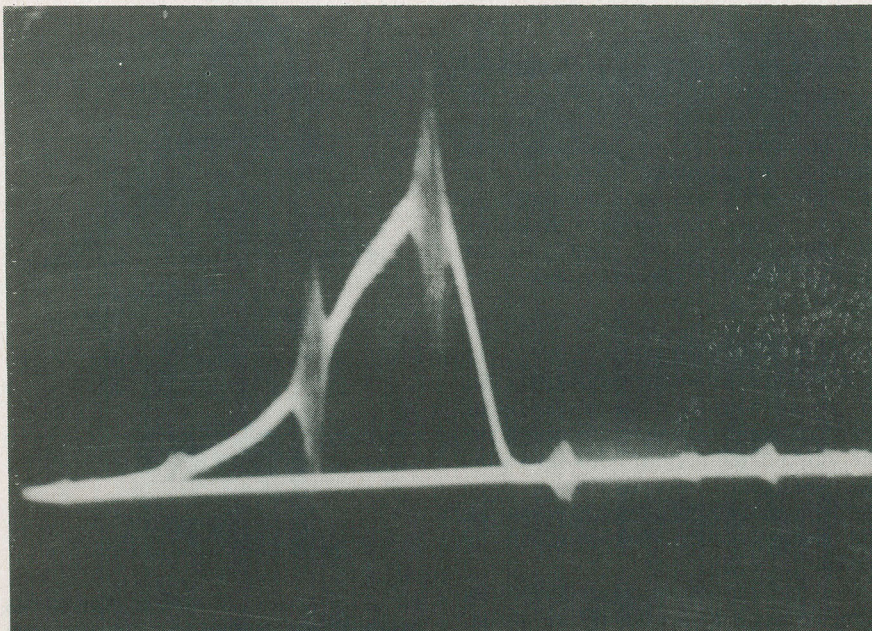


FIG. 4—CURVE BEFORE ALIGNMENT. Color on this set was very fuzzy.

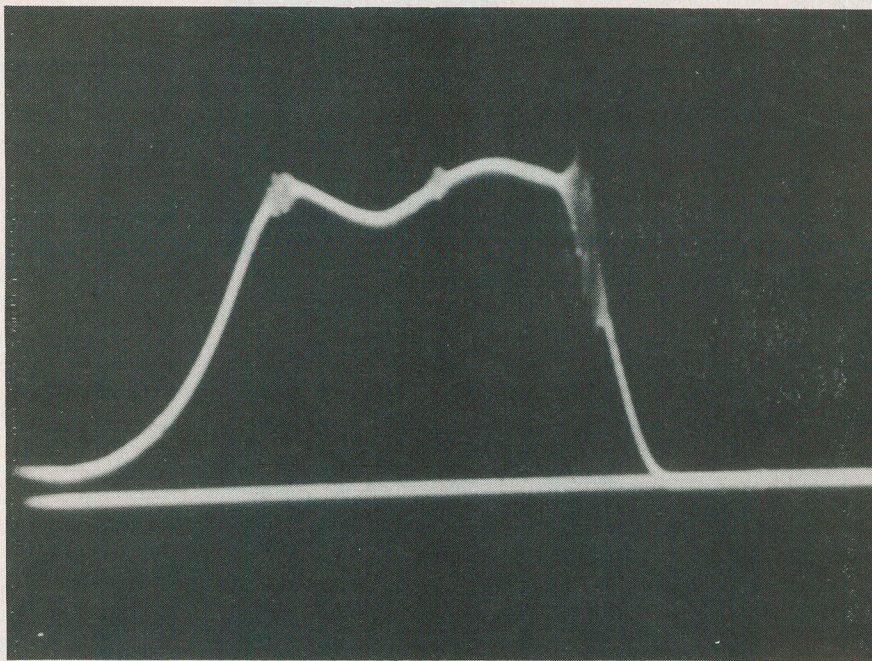


FIG. 5—IMPROVED COLOR CURVE. After alignment, markers are in their places.

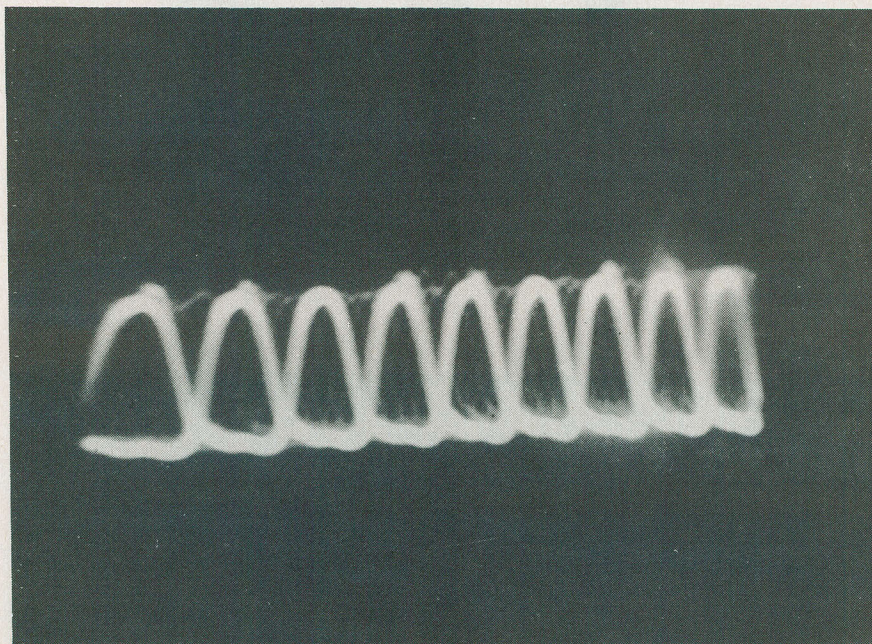


FIG. 6—SOUND TRAP ADJUSTMENT. This audio-modulated sweep signal is used.

see any audio signal. Detune it slightly in either direction to see the audio signal. Some of those signals are sharp enough so that you can actually get rid of all the audio signal, leaving only a straight line on the scope. You can also turn up the marker gain control of the sweep generator to make sure that you have the trap set to the exact point.

Incidentally, you can use the same method for setting any of the traps—the 41.25-MHz sound trap, etc. Feed in only the marker signal, with amplitude modulation, connect your scope to the video detector and tune the trap for minimum displayed audio signal. This method is considered by some to be

more accurate than using the whole curve; I find that both methods work very well.

Final checks

To familiarize yourself with these adjustments, hookups, etc., try them out on a TV that's working right. Make all the correct connections, then simply *look* at the curves in the various places. *Don't* move any of the alignment adjustments—this is very good practice!

Common sweep problems

We've covered a lot of sweep-alignment problems, but here are a few

reminders. You run into these problems at regular intervals, so watch out for them.

1. Incorrect bias. Symptom: no response curve at all. This usually means that the negative bias (in tube sets; can be positive or negative in solid-state TV's) is too great; the IF stages are simply cut off! Test: Reduce the bias and watch the curve. The bias, as well as the sweep-generator output, should *never* make any difference in the *shape* of the curve—only in its amplitude, as seen on the scope. Juggle the RF output, bias and scope gain to obtain the correct curve.

2. No curve but markers show. That one is easy. The RF output connection to the mixer test point has fallen off. Or it may be accidentally grounded to a shield. Or you forgot to turn up the RF output control of the sweep generator. In some generators, the video-detector connection may also have fallen off. Recheck all your connections.

3. Loops in the curve. Instead of a straight baseline, with the curve rising above it, you obtain something that looks like a figure-8 showing the curve and some of the markers. Cure: Replace the *ground lead* to the scope probe. It has probably fallen off or isn't making good contact. The loop you see is a stray 60-Hz AC frequency.

Helpful ideas

In conclusion, here are a few helpful nuts-and-bolts ideas. Some of the older scopes have good probes, but they tend to be somewhat massive. They are hard to hold when connected to the tiny lances and test points. You can often make a loop of test-lead wire with stout clips on each end and tape it to the body of the probe. Those wire ends can be clipped to the chassis, above the probe, to hold its weight.

For direct scope connections, construct special test leads, using miniature 50-ohm coaxial cable and miniature test clips. Use terminal fittings to match the input jacks of your scope. Those test clips are much lighter and easier to handle in the crowded spaces found in the later-model sets. Be sure to use the little slip-on rubber insulators to keep the clips from being grounded to the chassis.

Summary

We've tried to cover all possible alignment procedures and problems. Alignment work has been a bugaboo to too many technicians in the past. However, using the methods and techniques outlined in this article, you'll find that you can do a good job, even with older equipment. The work won't go quite as fast as with some of the newer models, but it *can* be just as accurate.

R-E

LIMIK

Bug your friends, office, or home. This harmless insect-like gadget is a sure-fire attention-getter.

MERRITT KEPPEL

THE LIMIK IS A HARMLESS MEMBER OF the species of electronic bugs...better make that insects. Like many electronic bugs it's sound-activated, but that's about where the resemblance ends. This bug is intended to be seen and heard.

The Limik has a definite insect-like appearance and can be used as a conversation piece, a psychological "watch-dog", or even as a noise-level meter in the office. If you want to attract someone's attention, just set the Limik down and watch what happens.

The Limik responds to noise by turning on its audio oscillator for a brief period of time. It emits a sound similar to a cricket's chirp and its eyes—two LED's—light up.

Its head is a miniature condenser microphone element and its tail is a piezoelectric sounder (see the September 1980 issue of **Radio-Electronics**). Its body is made up of a small PC board atop a 9-volt battery, and is supported by four brass legs.

How it works

The circuit is divided into three sections: an audio amplifier, a comparator/timer, and an audio oscillator—all of which are somewhat interactive. Refer to Fig. 1, as we discuss its operation.

The oscillator (output section) is the easiest to understand—it's a standard transistor multivibrator circuit, gated when the output of IC1-a goes negative. The frequency of the oscillator is determined by R11-C6 using the formula:

$$f = 1.38RC$$

where $R_{11}=R_{12}$ and $C_5=C_6$ to give a

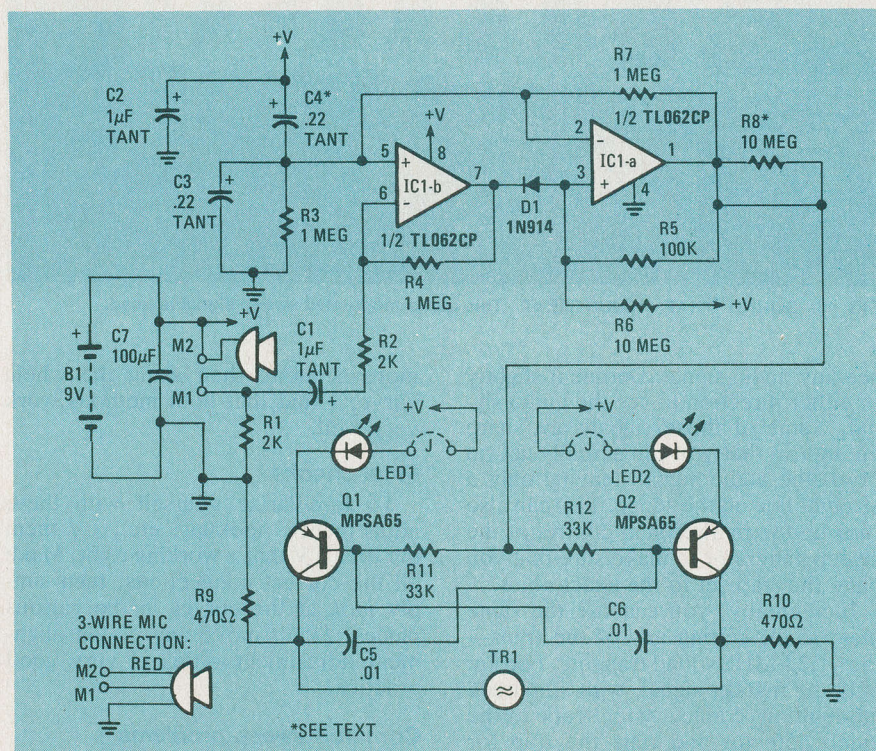
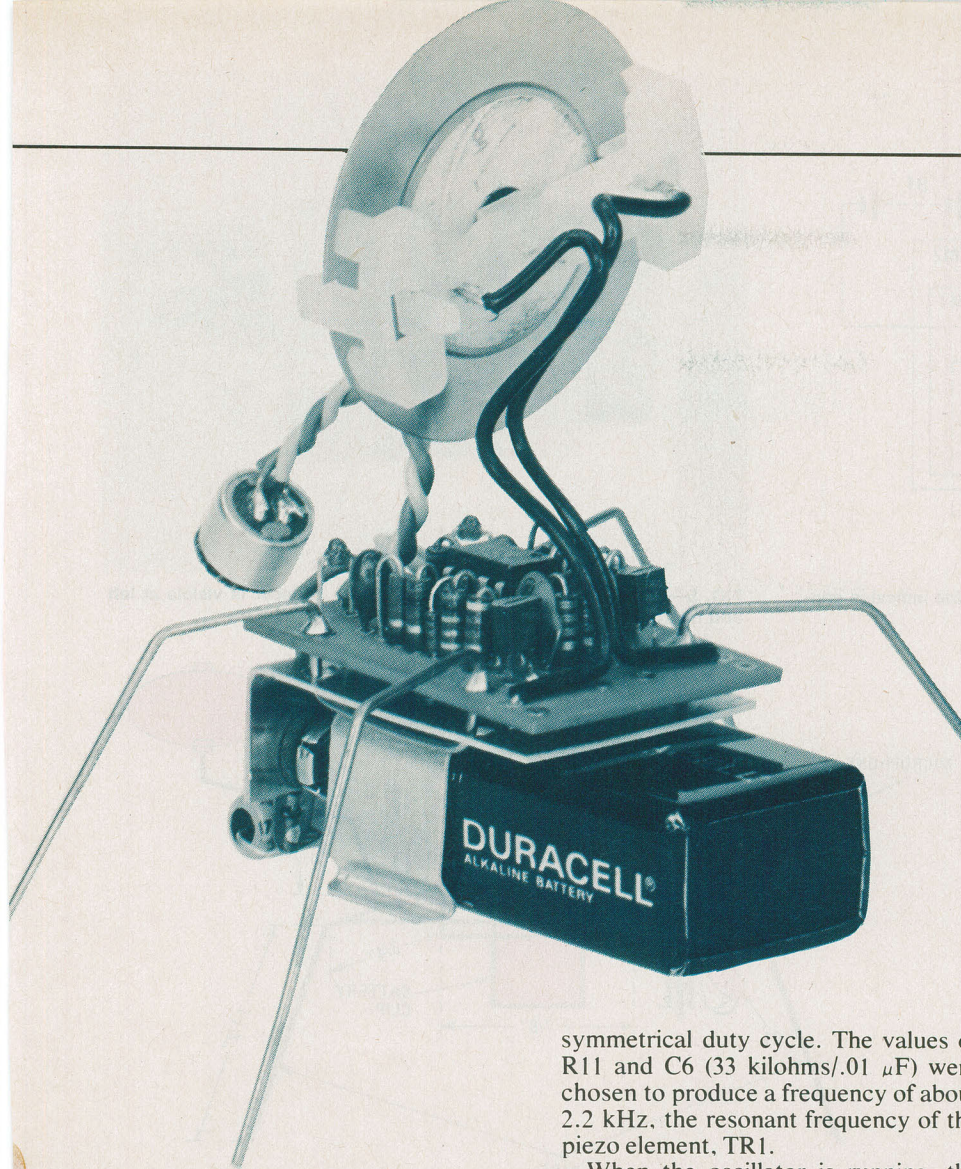


FIG. 1—ASTERISKS indicate components added for physical symmetry. Jumper across R8 effectively eliminates it from circuit. Connections for 3-lead microphone are shown at lower left.



symmetrical duty cycle. The values of R11 and C6 (33 kilohms/.01 μ F) were chosen to produce a frequency of about 2.2 kHz, the resonant frequency of the piezo element, TR1.

When the oscillator is running, the "eyes," LED1 and LED2, are forward-biased, and light. Resistors R9 and R10 develop a load for the oscillator and limit the current to the transistors and LED's. Battery life is determined by the

length of time the oscillator runs—it consumes the most power. If the Limik is not triggered, current drain is negligible (less than 1 mA).

The circuit is designed to use IC1, a TL062CP dual low-power FET op-amp, as an amplifier, comparator, and timer, all in one. Let's examine each element of that section of the circuit separately.

Amplifier: The output of the microphone is amplified by IC1-b, whose gain is determined by the ratio of R4:R2. In the Limik, that gain factor is 500. With no signal input, the output of IC1-b is equal to approximately $\frac{1}{2} V_{CC}$, a value determined by resistors R7 and R3 and IC1-b's logic-high state.

Comparator: Under no-signal conditions the output of IC1-a is at a "logic-high" state because its non-inverting input is at $\frac{1}{2} V_{CC} + V_D$ (where V_D is the voltage drop across diode D1) and its inverting input is at $\frac{1}{2} V_{CC}$. Negative-going signals at the output of IC1-b, if strong enough, will cause IC1-a to change states. That gives a comparator effect—if the input signal is not strong enough, nothing will happen; if it is, IC1-a goes to a "logic-low" state and triggers the timer phase of the Limik's cycle.

Timer: As soon as the output of IC1-a changes state, its non-inverting input is pulled to a level determined by $(R5/[R5-R6])V_{CC} + 0.6$ volt—approximately 0.7 volt. The output of IC1-a will remain low until the voltage at its inverting input becomes less than that at its non-inverting input. This is determined by the time constant of R7, R3, and C3, and is set at about 200 ms.

When the output of IC1-a returns to its high state, C3 charges through R7 towards a state of equilibrium (where it is neither charging nor discharging). Equilibrium, however, is not obtained

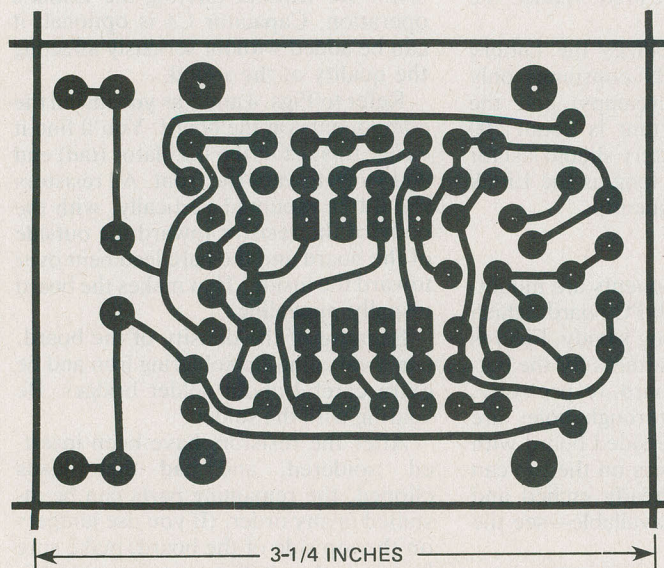


FIG. 2—PC BOARD measures just 1.2 by 1.6 inches. A prefabricated board is available if you do not wish to make your own.

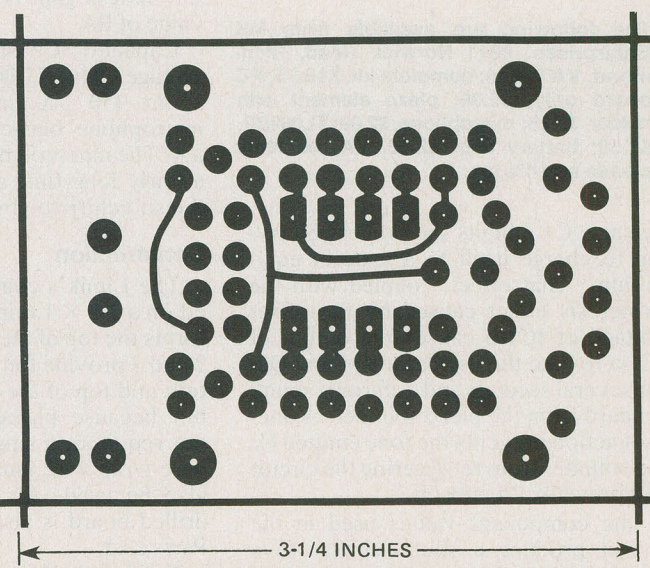


FIG. 3—TOP SIDE OF BOARD contains several traces necessary for proper operation. Since board is not plated-through, those traces may be replaced by jumpers.

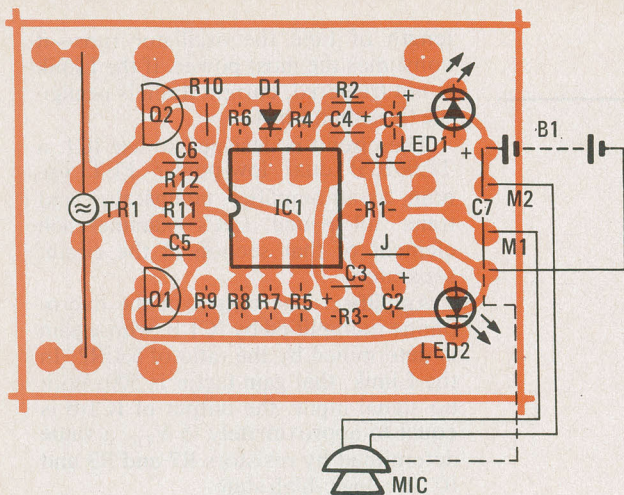


FIG. 4—LIMIK'S HEAD is at right; tail at left. Dashed line indicates connection for 3-lead electret microphone.

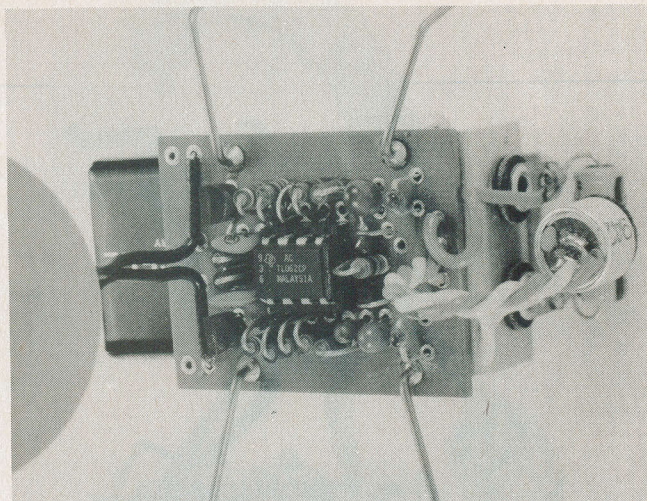


FIG. 5—COMPLETED CIRCUIT BOARD. Piezo sounder is visible at left and microphone and C7 at right.

PARTS LIST

All resistors 1/4-watt, 5%

R1, R2—2000 ohms
R3, R4, R7—1 megohm
R5—100,000 ohms
R6, R8—10 megohms
R9, R10—470 ohms
R11, R12—33,000 ohms

Capacitors

C1, C2—1.0 μ F, 35 volts, tantalum
C3, C4—0.22 μ F, 35 volts, tantalum
C5, C6—0.01 μ F, 25 volts, ceramic
C7—100 μ F, 10 volts, electrolytic

Semiconductors

IC1—TL062CP or equivalent FET-type 747 dual op-amp
Q1, Q2—MPSA65 Darlington pair
LED1, LED2—MV-50 subminiature LED
D1—1N914 or 1N4148
TR1—piezo sounder (Gulton 105-CFB or equivalent)

B1—nine-volt battery

Miscellaneous: PC board, 2 or 3-lead electret microphone, holder for piezo sounder, battery holder (Colectro No. 86 or similar), 3/64-inch brass rod for legs, etc.

The following are available from MK Enterprises, 8911 Norwick Road, Richmond, VA 23229: complete kit, \$18.95; PC board only, \$5.00; piezo element with holder, \$2.25; microphone, \$2.00; TL062CP, \$1.50; battery clip, \$2.00. VA residents please add 4% tax.

because C1 inhibits the process by trying to charge itself to a state of equilibrium. That effect, coupled with the hysteresis effect caused by the offset voltage of IC1-b causes the output of IC1-a to gate the oscillator (Q1 and Q2) for several seconds and a chirping sound is heard from the piezo sounder. A one-shot action prevents the tone emitted by the sounder from retriggering the circuit and prevents "feedback."

The component values used in the circuit produce a sound similar to a cricket's chirp. They may be changed, if desired, to modify the sound. For good performance, though, make sure that C3

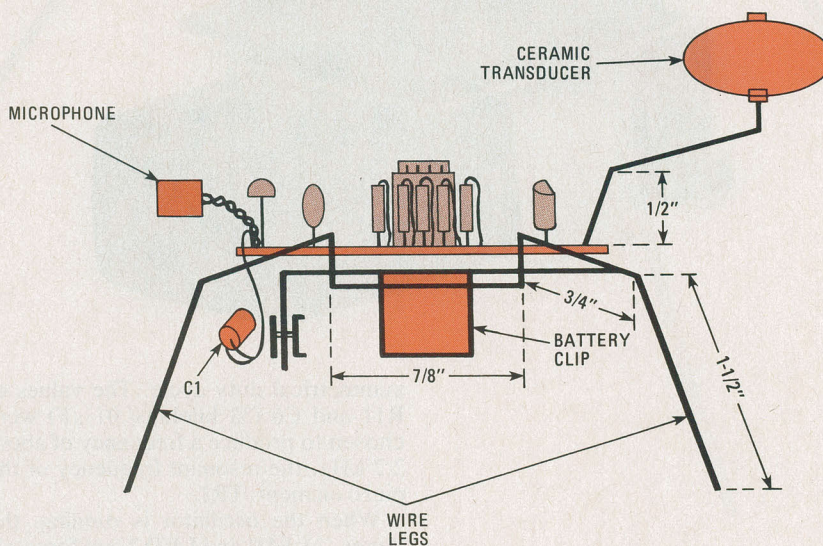


FIG. 6—SIDE VIEW OF LIMIK. Legs are made of 3/64 brass rod bent as shown and splayed out to sides.

is no more than six times the value of C1. If less gain is desired, reduce the value of R4.

Capacitor C7 stabilizes the battery voltage. The TL062N consumes only about 150 μ A (microamps) and the microphone bias-current is about 700 μ A. The nine-volt battery should last for a fairly long time as long as the Limik doesn't chirp too frequently.

Construction

The Limik's components are mounted on a 1.2 \times 1.6-inch PC board, which forms the top of the bug's body. Figures 2 and 3 provide foil patterns for the bottom and top of the board, respectively, but because plated-through holes are not required, a single-sided board with wire-wrap wire jumpers on the top can also be used. An already etched and drilled board is also available—see the Parts List.

To give the Limik a symmetrical appearance, several components are added which serve no real functional pur-

pose. If you like, you can eliminate resistor R8 without altering the Limik's operation. Capacitor C4 is optional; it can be added without seriously affecting the quality of the sound.

Refer to Figs. 4 and 5 as you install the components on the board. You'll find it easier to start at the oscillator (tail) end and work toward the front. All resistors should be mounted vertically, with the body of the resistor toward the outside of the board and the bare lead bent over toward the inside. That makes the board visually appealing.

Because of the density of the board, use a very fine-tip soldering iron and be extra careful about solder bridges. Be sparing with the solder.

After the resistors have been inserted, soldered, and had their leads clipped, the remaining parts can be installed in any order. (If you use jumpers on the top side of the board, make sure they're in place before you mount the IC socket.)

Be sure to observe the polarities of

C1, C2, C3, and C4, if used, as well as those of the two LED's and D1. Also, make sure that the two jumpers indicated by "J" are in place.

When all the on-board components are mounted, it is time to install the microphone and piezo sounder. First, cut four 2-inch lengths of No. 22 solid wire and strip the ends. (If the wires are of different colors—say red and yellow—they'll enhance the appearance of the Limik.) Solder the red wires to the positive battery and microphone pads, and the yellow wires to the negative ones.

Connect the battery leads to the appropriate terminals on the battery clip and install capacitor C7 across them. Again, watch the polarity.

The original Limik used a 2-terminal microphone. The red wire from point "M2" was attached to the mike's positive terminal, and the yellow one from point "M1" to its negative (case) terminal. If you use a 3-terminal microphone, connect the mike's red lead to +V (point "M2"), its audio lead to "M1", and its ground lead to -V.

Form two lengths of No. 22 solid wire as shown in Fig. 6 and connect them to the piezo sounder. The original Limik used a "naked" sounder that was mounted in a Molex holder. The one you use may have a case, and the wires can be threaded through the holes in the "ears" for added support. The other ends of the wires are soldered to the PC board as indicated in Fig. 6.

Checkout

Before you attach the battery clip to the PC board, it's a good idea to check out the circuit to make sure that it works. Now is a good time to make other last-minute adjustments—such as the height of the "eyes" (about 0.2-inch)—too.

Plug IC1 into its socket and then slip a 9-volt battery into the clamp and connectors. When you make a noise (whistle, clap your hands, shout...) the LED's should light and you should hear the Limik chirp.

If nothing happens, first check to see that everything—including the battery—is inserted properly and in its proper place. Make sure that you've soldered all the points necessary, and if you're using jumpers, that they are in place.

You can verify the condition of the LED's by temporarily bridging a 1K resistor from their cathodes (banded ends) to the negative battery terminal. That should cause them to light.

If the sound from a "naked" sounder is raspy, or erratic, check its mounting in the holder. The contact pins may need to be bent to provide more pressure.

Finishing up

When the circuit is working properly,

clip or file the leads on the foil-side of the board as short as possible. Again, check for proper operation.

Now, referring again to Fig. 6, form the legs from two 6-inch lengths of $\frac{3}{16}$ -inch brass rod. Insert them from the battery-side of the holder up through the PC board. Solder the legs firmly to the PC board (bottom and top, if possible) and adjust them so the Limik's body is parallel to whatever surface it stands on.

With that, your Limik should be complete. Have fun—but don't let it "bug" you.

R-E

HI-FI CX DECODER

continued from page 46

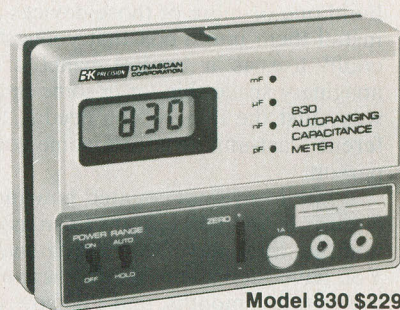
millisecond attack time and a 30-millisecond decay time, to handle high-level transients, consists of C4, R15, R16, and Q3. The output of Q3 feeds into summing amplifier IC2-c through R17, where it joins the gain-control signal that is summed through R18. Op-amp IC2-c and transistor Q4 make up a voltage-to-current converter, and the collector of Q4 supplies the control current for the left- and right-channel transconductance amplifiers.

The LED-indicator circuit consists of a dual-element (red and green) LED driven by two voltage comparators (IC4-b and IC4-c). When S2 is in the OFF position, the LED's common cathode is unconnected; when S2 is ON, the common cathode is grounded. The comparators' reference voltages are derived from the +15-volt power supply through R49, R50, R51, and R52. The reference voltages are slightly higher and lower than 5 volts, which is the DC voltage that should appear at TP1 when a 0-dB reference signal is supplied to the expander. For low-level signals where the voltage at TP1 is less than 5 volts, IC4-c supplies a current through R53 to the green element of the dual LED, causing it to light. For signals where the voltage at TP1 is exactly 5 volts, IC4-b supplies a current through R54 to the red element of the dual LED, causing it to light. Since, at that voltage, both elements of the LED are lit, the LED will glow with an orange color. If the voltage at TP1 slightly exceeds 5 volts, the voltage from IC4-c is cut off, leaving just the red element of the LED lit.

That concludes the theory section of the CX expander. A foil pattern for the single-sided PC board required is shown in Fig. 4 for those of you who want to be ready for the construction portion of this article, which will appear next month.

R-E

Measure capacitance fast and accurately with the autoranging B&K-PRECISION 830



Model 830 \$229
Model 820 \$185 (not shown)

The 830 offers features that are tough to match at any price, such as 0.1 pF resolution, large $\frac{3}{2}$ -digit LCD display and fuse protection against charged capacitors. Basic accuracy is 0.2%, much greater than the tolerance of most capacitors. Measurement range extends to 199.9 mF.

Simplicity of operation is another strong suit for the 830. For checks limited to a narrow value range, the "range hold" capability can lock the 830 onto one range—an added time saver. This feature, along with its fast reading time, makes the 830 especially valuable for incoming inspection applications.

For applications suited to manual ranging, B&K-PRECISION offers the LED readout 820 at an even lower cost.

With either B&K-PRECISION C-meter you can, measure unmarked capacitors... verify capacitor tolerance... measure cable or switch capacitance... match capacitors for critical applications... measure complex capacitor networks... set trimmer capacitors.

Call toll-free 800-621-4627 for the name of your nearest distributor and see why B&K-PRECISION is the leading supplier of digital capacitance meters.

B&K PRECISION
DYNASCAN CORPORATION

6460 West Cortland Street
Chicago, Illinois 60635 • 312/889-9087

Intl. Sls., 6460 W. Cortland St., Chicago, IL 60635
Canadian Sales: Atlas Electronics, Ontario

CIRCLE 71 ON FREE INFORMATION CARD

HOBBY CORNER

A winner of a circuit to keep any young person amused.

EARL "DOC" SAVAGE, K4SDS, HOBBY EDITOR

WITH THE HOLIDAY SEASON ALMOST upon us, this seems as good a time as any to close down the idiot box "contest." Those of you who are regular readers of this column know that we have been looking for circuits that have no useful purpose, yet put on an interesting visual and/or audio show—they just *seem* to do a lot. The idea is to build one or more of those devices and install them into a box that youngsters could use as a control panel of an imaginary space ship, or in some similar way. Just the thing if you need a "different" last-minute gift for some young person.

While I have not counted how many circuits have been sent in, I can assure you that there have been a great many. You have seen some of them here over the past few months, and I'll show you others from time to time, although the competition is closed. By the way, even though the contest is over, if you come up with a good one, be sure to send it in and let us have a look at it.

For now, however, here is the “winner.” I will admit that the call was a close one. In fact, it was a four-way tie nearly until the end. The honors must go to MSGT Jerry Duke (APO New York) for the circuit that follows.

Jerry's entry is shown in Figs. 1 and 2. He uses a CD4060 oscillator/divider to drive the rest of the circuit. That IC drives a 74154 demultiplexer, the output of which is latched by four CD4044 quad R-S latches. The output of the latches are displayed on an array of LED's that are arranged to spell out anything you wish. For good measure, Jerry throws in an XR2242 long duration timer to add appropriate (or inappropriate) sound effects.

One way to arrange the LED's is shown in Fig. 2. Each array is made up of from two to four LED's. The arrays are wired into the main circuit at the points indicated. You can arrange the LED's to spell out anything you wish, of course.

Those LED's do not just turn on and off. The circuit goes through 16 cycles. On the first cycle, the first array is lit; on the second cycle, the first and second arrays are lit, and so on. While the lights are going through their paces, the time constant that determines the fre-

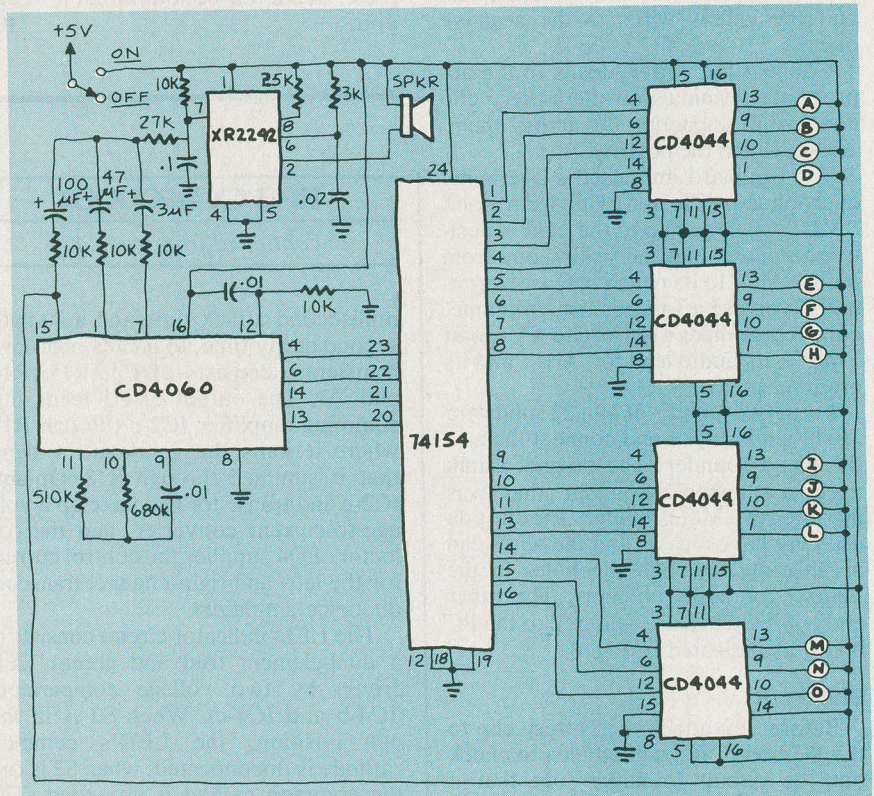


FIG. 1

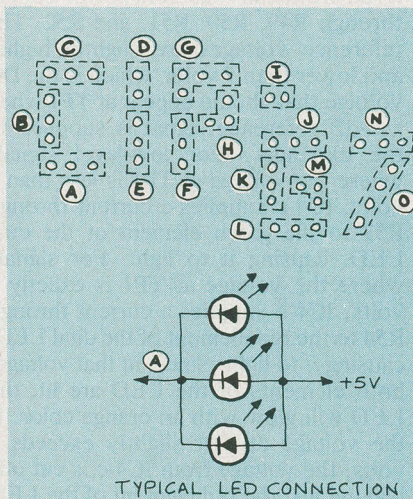


FIG. 2

quency of the XR2242 is being changed by the CD4060. The result of that is a varying whooping and wailing sound that accompanies the LED patterns.

All-in-all, Jerry's circuit is just right

for the idiot box; it is fascinating, yet useless! Thanks to him, and all of you for sharing your ideas.

Sidereal clock

Back in the August 1981 "Hobby Corner," I told you about H.C. Gernhart's search for a sidereal clock circuit. It seems it wasn't astronomy that I had forgotten—just logic! Alan Gee (Sunnyvale, CA) tweaked me gently about the fact that the clock must run *faster* than a normal clock.

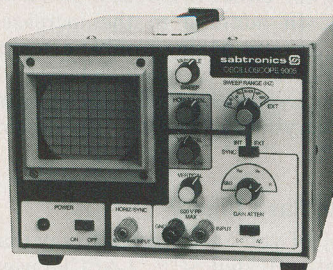
He, and a couple of other readers, called attention to an article in the July 1976 issue of *Sky and Telescope* magazine. That article includes a schematic and description of a sidereal clock that looks quite good. It is highly accurate, and does not appear too difficult to build.

The basic idea behind that, and most other similar clocks, is to supply an extra timing pulse periodically to a

continued on page 78

SABTRONICS NOW OFFERS AN ENTIRE RANGE OF TEST AND MEASUREMENT INSTRUMENTS AT LOW LOW PRICES

All
merchandise
advertised is ready
assembled and factory
tested.



Sabtronics SUPERSCOPE Model 9005 at super low price

Features:

- ☆ Sharp clear 3" CRT
- ☆ Lower threshold triggering: less than 1/2 division at 5MHz
- ☆ Sharper focus especially at high frequencies
- ☆ Fiberglass pcb
- ☆ Colour coded input terminals
- ☆ and a usable response to beyond 5MHz

Specifications:

- Usable bandwidth DC to 5MHz plus
- Vertical deflection sensitivity: 10mV per division
- Horizontal deflection sensitivity: 500mV per division
- Time base sweep frequency: 10Hz to 100kHz in 4 ranges
- Synchronisation: internal and external
- Size: 202(W) x 160(H) x 306(D) mm
- Weight: approx. 3.8 kg

only
\$229.00



Interfaceable DMM Model 2020 MP

Features:

- ☆ 0.1% basic DCV accuracy
- ☆ 10 amps current measurement
- ☆ 31 ranges and 6 functions
- ☆ Hi power and Lo power Ohms
- ☆ Unique touch and hold capability**
- ☆ Battery or AC operated***
- ☆ Interface for most popular computers included

Specifications:

- 3 1/2 digit large 0.4" LED readouts
- Automatic decimal and minus (-) sign
- ACV frequency response: 40Hz to 40kHz on 200mV, 2V and 20V ranges
- Overload protection: 1200V (DC+AC peak) on all voltage ranges

**CRT not included

***Batteries or AC adaptor optional

Give your computer test and measurement capabilities by
using our interfaceable Model 2020 MP DMM.

\$299.00

Features:

- ☆ Wide 1Hz to 200kHz frequency range
- ☆ Sine, square, triangle and separate TTL square wave output
- ☆ Continuously variable output to 10V P-P
- ☆ Frequency sweepable over 100:1 range
- ☆ Short-circuit proof outputs
- ☆ Venier frequency dial with fine adjustment control

Low cost Function Generator Model 5020A



Specifications:

- Frequency range: 1Hz to 200kHz in five overlapping decade ranges.
- Waveforms: Sine wave: Distortion <1% from 1Hz to 100 kHz; <3% from 100kHz to 200kHz
- Square wave: Rise/fall time <250nsec. Symmetry <98%
- Triangle wave: Non-linearity <1% to 100kHz
- Output: Impedance: 600Ω short-circuit proof. Amplitude (continuously variable): 10V P-P open circuit; 5V P-P into 600Ω max. Low Level: -40dB of high output. TTL square wave: >10 std. TTL loads
- Sweep input: Impedance: 27kΩ. Range: >100:1. Input voltage: Up to ±10V.

\$129.00

Features:

- ☆ 9-digit resolution for more precise readings
- ☆ Excellent 30mV sensitivity up to 1GHz
- ☆ 3 switch selectable gate times
- ☆ 10MHz crystal controlled time base for greater accuracy
- ☆ 2 separate inputs for added versatility
- ☆ Front panel sensitivity control

1GHz 9-digit Frequency Counter Model 8000B



Specifications:

- Frequency range: Model 8000B: 10Hz - 1GHz in 3 ranges. Model 8610B: 10Hz - 600MHz in 3 ranges
- Display: 9-digit 0.4" (10 mm) LED with automatic decimal point; separate LED gate activity indicator
- Resolution: 10MHz range: 0.1Hz with 10s gate time. 100MHz range: 1Hz with 10s gate time. 600MHz/1GHz range: 10Hz with 10s gate time
- Sensitivity: <20mV rms, 10Hz - 100MHz; <30mV rms, 100 - 600MHz; <35mV rms, 600MHz - 1GHz
- Input impedance: Input A - 1MΩ/100pF. Input B - 50Ω nominal
- Time base: Frequency: 10MHz. Stability ±2ppm. Temperature stability: ±1ppm from 0 to 40°C.
- Gate time: 0.1 second, 1 second, 10 seconds switch selectable.

\$239.00

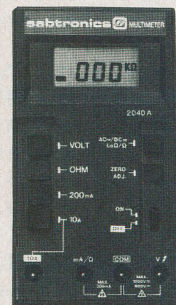
**Model 8610B 600MHz for only \$169.00

AUTORANGING DMM Model 2040 with 10 amps current measuring capability

This is a very sensitive, general purpose instrument which provides the facilities and quality required by today's electric/electronic technicians and engineers.

Specifications:

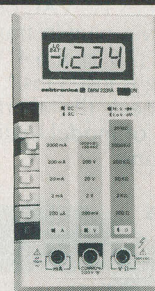
- Display: Numerical display: 3.5 digit LCD, maximum reading 1999. Unit and sign: mV, V, mA, A, Ω, KΩ, AUTO, BATT, ADJ, LO, -, AC
- Range selection: Autoranging on VOLT and OHM
- Polarity: Autopolarity, (-) sign when minus, (+) sign is implied and is not shown
- Battery warning: LO BATT sign
- Sampling rate: Two times per second
- Power consumption: 5mW typically
- Power supply: Two 1.5V batteries, type UM-3 or AA
- Battery life: 300 hour continuous operation
- Overload protection: One 3A 600V, BBS type fuse and one 0.3A 250V, 5x20 mm fuse for OHM and mA ranges
- Operating temperature and humidity: 0 to +40°C, less than 80%
- Zero adjustment: Zero adjustment by ZERO ADJ. Keyswitch
- Low power OHM ranges: For in-circuit resistance measurements at voltage levels below 0.33 volts



\$129.00

Features:

- ☆ Easiest operation: AUTORANGING SYSTEM requires no range selections
- ☆ Easiest reading: Automatic indications of units, signs, polarity, decimal point, overrange and battery warning
- ☆ Low battery consumption of 5mW: 300 hour continuous use with two 1.5V batteries, type UM-3 or AA
- ☆ Difference Measurements: This instrument can be used like a galvanometer
- ☆ Ultimate Portability: Actualized light weight and compactness in excellently designed ABS cases



Low Cost Handheld DMM Model 2038A

Features:

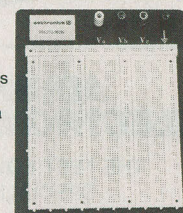
- ☆ 3 1/2-digit LCD display
- ☆ 0.6% basic DCV accuracy
- ☆ DC voltage: 1000V
- ☆ AC voltage: 750V
- ☆ Input impedance: 10MΩ
- ☆ Low battery indicator
- ☆ High impact ABS case
- ☆ AC/DC current: 2 amps
- ☆ Overload protection
- ☆ 2000 hours battery life
- ☆ Auto zero

\$89.00

Solderless Breadboard Model 356S

Features:

- ☆ 3 terminal strips 5 distribution strips
- ☆ Aluminium plate
- ☆ Size: 200x175x8 mm actual area of breadboard
- ☆ Silver-plated contacts
- ☆ Accept all DIP size including RTL, DTL and CMOS devices
- ☆ Interconnect with any solid 20 to 29AWG (0.3-0.8 mm) wire
- ☆ Breadboard elements are mounted on ground plane, ideal for high frequency, high speed and low noise circuit



\$39.95

Other models also available.

Logic Probe Model LP-1

Features:

- ☆ Input impedance: 100KΩ
- ☆ Operating frequency: 10MHz
- ☆ Min. detectable pulse width: 50nsec.
- ☆ Input overload protection: ±50V Cont.
- ☆ Power requirements: 5 to 15V less than 30mA.
- ☆ LED indicator for HI and LO
- ☆ Memory and DTL/TTL CMOS switch



\$24.95

We also have many other products. Contact us for our full catalogue.

Ordering Information:

Domestic: Shipping and Handling, add 10% of purchase up to \$100.00, add 5% on orders over \$100.00.

For orders call: (813) 623 2631 9 A.M. to 5 P.M. E.S.T.

We accept Master Charge or VISA Credit Cards. Florida residents add 4% Sales tax.

Overseas orders: Add \$25.00 for all instruments except Model 9005 Scope: Add \$65.00 or ask us for a list of our overseas distributors.

sabtronics

INTERNATIONAL INC.

Sabtronics International, Inc., 5709 N. 50th Street, Tampa, FL 33610 USA
Telephone (813) 623 2631
Telex 808 700 sab tpa

HOBBY CORNER

continued from page 76

standard digital-clock IC. It seems that if an extra pulse is provided after every 365th regular pulse, the clock will differ from sidereal time by less than a minute a year. While additional circuitry can be added to increase the accuracy, the small difference should not be a problem for most applications.

Paul Beckman (Texas A&M University) and Bob Schalk (Clearwater, FL) both sent in good looking designs that they developed themselves. Space

doesn't permit showing them here, but Paul makes the point that provision should be made for a battery back-up in case of a power failure.

Thomas Troutman sent us some helpful information and also said that by the time you read this he will have available clock kits and assembled units. You can contact him at Antares Electronics, PO Box 32802, Phoenix, AZ 85064.

Thanks to all of you for helping out.

Catching up with the mail

The mailbox has been unusually heavy the last few months, and I want

to thank each of you who has sent in a suggestion or question. I especially enjoy seeing those solutions to other readers' questions—you come up with some good ones. Thanks for taking the time to write.

For those of you who enclosed self-addressed, stamped envelopes and are looking for direct responses, please be patient. In addition to the increased mail, I am still having trouble catching up because of a recent change of address. Eventually I will get caught up with everything. (Well, I can dream, can't I?)

Remote flash trigger

Many of you have written to say that the light-activated SCR (LASCR) used in the slave-flash circuit (July 1981) is no longer stocked by Radio Shack. Palmer Swails (San Antonio, TX) wrote to let us know that a suitable replacement is available from Solid State Sales (PO Box 74D, Somerville, MA 02143). Their toll-free telephone number is 1-800-343-5230.

While we do try to keep things as current as possible, you should be aware that considerable time may elapse between the development of a circuit, my write-up of it, and its appearance in your copy of **Radio-Electronics**. Occasionally, unanticipated changes will take place. In such a case, do what Palmer did—he just called the toll-free numbers of our advertisers when he could not find the part locally.

Reader requests

W.D. Ennis of Idaho Falls, ID is looking for a circuit to measure the velocity of a bullet. That would be handy for those who load their own ammo.

Leonard Eisner of New York, NY needs a circuit that will turn on an LED at 9 volts, and turn it off when the voltage falls below that point. He wants the device to be safe up to at least 15 volts. I'm not sure what he wants to use it for, but what can you come up with?

Lester Jernigan of Jacksonville, FL wants to expand the bandwidth of his oscilloscope. Short of a major rebuilding job, do you know of anything that will convert the signal down in frequency and will also provide a useful display?

Ward Pearce of La Grange, GA is looking for a way in which he can display all eight ignition patterns in parallel on his scope.

Donald Carter of Cincinnati, OH is looking for a way to make a bank of potentiometers programmable. That would be useful for music synthesizers and other sound generators—it often takes a long time to set the controls on those for exactly the sound you want. Any help on this one?

R-E

**ADVANCE IS PROUD
TO INTRODUCE
Non-Linear Systems**

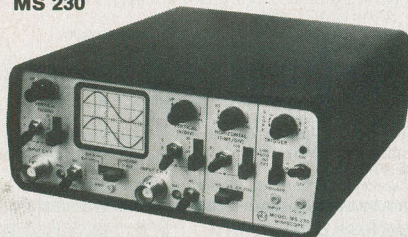


**High Quality Oscilloscopes
Backed by
A Two-Year Warranty**

* (Exception: model MS-230 is slightly deeper, at 8.6", and heavier, at 3.6 lbs.).

MODEL	VERTICAL BANDWIDTH	DEFLECTION FACTOR	TIME BASE
MS-230	30MHz	10mV to 50V/div. 12 Ranges	0.05µ Sec to 0.2 Sec/div. 21 Ranges
MS-215	15MHz	10mV to 50V/div. 12 Ranges	0.1µ Sec to 0.5 Sec. 21 Ranges
MS-15	15MHz	10mV to 50V/div. 12 Ranges	0.1µ Sec to 0.5 Sec. 21 Ranges

MS 230



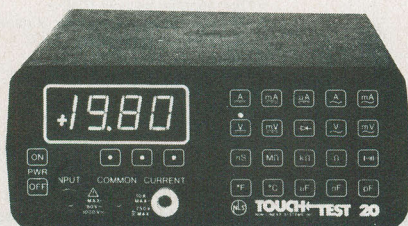
**ADVANCE
ELECTRONICS**

**THE TEST EQUIPMENT
SPECIALISTS**

**TOLL FREE HOT LINE
800-223-0474**



54 WEST 45th STREET,
NEW YORK, N.Y. 10036 212-687-2224



Call For
Special Introductory
Price Offer

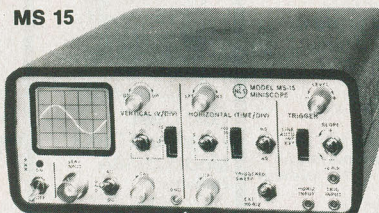
MS 215



Non-Linear Systems' trio of mini-oscilloscopes are accurate, affordable, portable. And there's one to match nearly every budget and need. Standard features on all models include an input impedance of 1 megohm with 50 pF; maximum input voltage of 350 V; trigger modes in auto, internal, external and line; slope that's + or - selectable; graticule (4x5 division of 0.25" each); dual power sources operating either internally from rechargeable lead acid batteries or externally from 115 VAC or 230 VAC (50-60 Hz) via plug-in transformer; handy size (2.9"H x 6.4"W x 8.0"D) and weighs just 3 lbs.*

Check the chart below for details of model features and specifications.

MS 15



The remarkable Touch Test 20 DMM. With the Touch Test 20 Non-Linear Systems introduces the 2 lb. 4 oz. test lab. Now, with 20 key test functions at your fingertips (plus the ability to measure 10 electrical parameters and 44 ranges), you can take one lab to the field instead of a cumbersome collection of individual testers.

The new Touch Test 20 DMM features:

- Built in temperature measurement (including probe; F° and C°)
- Capacitance measurement
- DC Voltage (200 MV - 1000V)
- AC Voltage (200 MV - 1000V)
- DC Current (200 µA - 10A)
- AC Current (200 µA - 10A)
- Resistance (200 Ω - 20MΩ)
- Diode Test

Introducing the first no crystal hand-held scanner. The Bearcat® 100.



Now you can have the one scanner you've always wanted—a no crystal, fully synthesized hand-held scanner. The incredible, new, Bearcat 100.

Push button programming.

The new Bearcat 100 works just like the full size, no crystal Bearcat Scanners. Push button controls tune in all police calls, fire calls, weather warnings, and emergency information broadcasts, the split second they happen. Automatically.

All the features you want.

16 channels for storing

frequencies. 8 band coverage—including high, low, UHF and "T" public service bands; both the 70 cm and 2 meter amateur bands; plus, for the first time ever, both the military and federal government land mobile bands. Both automatic and manual search, lockout, scan delay, direct

channel access. Even a liquid crystal display. Flexible antenna, earphone, AC adapter/battery charger and carry case are included.

Your Bearcat Dealer wants to hand you an earful.

See your Bearcat Dealer now for a demonstration of the amazing, new Bearcat 100. Get complete information about the world's one and only hand-held, no crystal scanner.

BEARCAT® SCANNERS

Electra Electra Company
Division of Masco Corp. of Indiana
300 East County Line Road
Cumberland, Indiana 46229
International Business Office
Suite 102, 1828 Swift
North Kansas City, Missouri 64116

© 1981 Masco Corp. of Indiana.

CIRCLE 47 ON FREE INFORMATION CARD

COMMUNICATIONS CORNER

FM for CB: Won't they ever learn?

HERB FRIEDMAN, COMMUNICATIONS EDITOR

CITIZENS-BAND OPERATORS AND THE FCC have been at odds since the inception of the service. The problem, at least as seen by the FCC, is that the public has refused to fit the mold of an "uplifted" citizens' radio-service. Instead, the result has been a new class of lawbreakers, with more unlicensed CB'ers now using the service than "legals."

Do you think that anyone has learned anything from our CB version of Prohibition? Probably not, judging from the contortions that the FCC's European counterparts are now going through in an attempt to hold off those who want an "unrestricted" CB service on the Continent. The contention this time, though, is over an interesting technical variation—a CB service using FM.

The first reaction to FM for the CB service is approval. After all, FM would reduce impulse-noise interference, greatly increasing the "effectiveness" of CB communications. In fact, using FM for the U.S. CB service had once been considered and recently the idea has been revived because of the European interest.

But is FM really an improvement for CB? Consider the reasons behind the European interest in FM-CB. European manufacturers, who have always preferred a protected market for their products, are trying to avoid the fate of the U.S. CB industry—which, although initially successful, was eventually wiped out by the imports. The feeling among the Europeans is that, since the Asian manufacturers are currently producing AM transceivers for the U.S. market, they are unlikely to retool their facilities to produce FM units for the much smaller European one.

That, however, has nothing to do with the question of FM's benefits. For an answer, you have to consider whether or not FM really improves the effectiveness of the service—and it all depends on who is defining the term "effective." It appears that the European officials equate *effectiveness* with *short range*—European output-power levels are unusually low. In fact, the Dutch originally permitted a maximum output of only 0.5 watt, AM. Because of that, the signal range was next to useless, and the system bombed. Finally, in an attempt to prevent the high-power

bootlegging that occurs here, the Dutch instituted a 40-channel FM-CB service with a maximum output of 2 watts. Unfortunately, many Dutch CB'ers are studiously avoiding that service.

Elsewhere in Europe, CB'ers have shunned FM like the plague. Tune across 11 meters in France and you'll notice that the band is bursting with AM. The same holds true in Germany. In fact, if you get stuck anywhere in Europe and call for assistance using AM, you'll probably raise someone.

Capture effect

Why the opposition to FM? Simply because it does not work for CB. One of FM's strong points is the *capture effect*—the ability of the strongest signal on or near the frequency to wipe out *completely* any weaker signal. Technical experts claim that because of the capture effect FM enjoys sharply reduced interference from co-channel signals. While a co-channel AM signal with only 1/100 of the strength of the other can cause considerable interference, even poorly designed FM detectors have no problem in locking onto signals in the presence of co-channel interference as much as 1/10 as strong.

But that is precisely what the European CB'ers object to. They claim that

using FM they cannot hear "breakers," and that distant emergency signals cannot avoid being "killed" by the capture effect, making 11 meters useless.

FM is easy

What about the hope that an FM-CB system will remain immune from foreign competition for a long time? That hope is based on the belief that the conversion of American transceivers (as all AM transceivers are called in Europe, regardless of their place of manufacture) to FM at a reasonable cost will be impossible until new IC's are developed. However, that IC is already here.

Figure 1 is a schematic for an FM detector that can be added to any AM receiver with a 455-kHz IF. The circuit originally appeared as a "weekend project" in the March 1981 issue of *Ham Radio* magazine. It can be built on a piece of perforated board not much larger than two postage stamps.

The heart of the circuit is an MC1358 IC. It was originally intended for use in TV-sound circuits, where the transmitted FM-deviation is 25 kHz. It also works well for NBFM (Narrow Band FM). The device contains an IF amplifier, an FM detector, a limiter, and an audio preamplifier. Alignment could not be

continued on page 82

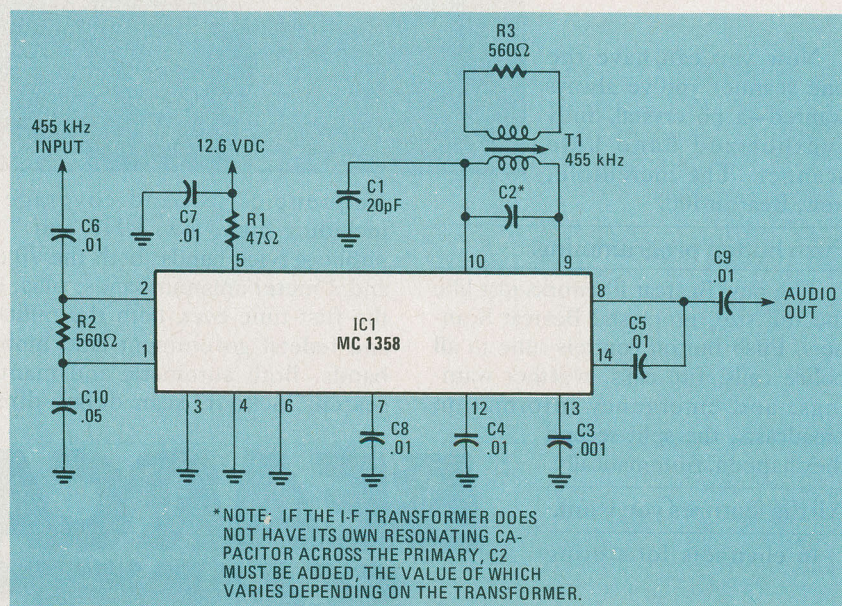


FIG. 1

“You fix TV’s... what brand should I get?”

You’re on the spot. Any set you tell your customer about has a chance of failing sometime.

But though we’re not saying we’re perfect, we’d like you to recommend RCA. Because we’re sure your customer will love its picture performance.

You can find the problem and repair it quickly if anything does go wrong. Because with RCA’s unitized chassis, failures are easy to handle.

RCA gives frequent hands-on workshops, as well as lectures. So when failures do occur, you’ll be ready.

RCA has more than 500 parts distributors nationwide. We have this large network because we don’t want you to have to wait too long for parts.

We also keep your inventory expenses lower by using components instead of modules, in most circuits.

We know your customers think you’re responsible for everything about their sets.

Good and bad.

And that’s why we here at RCA are doing everything possible to make sure that when you finish a service call, everybody’s smiling. Your customer’s happy with your recommendation. And you’re still the expert.

RCA
**RCA IS MAKING
TELEVISION
BETTER AND BETTER.**



For your free subscription to RCA COMMUNICATOR, our magazine of news and advice for service technicians, write RCA, Dept. 1-455, 600 North Sherman Drive, Indianapolis, IN 46201.

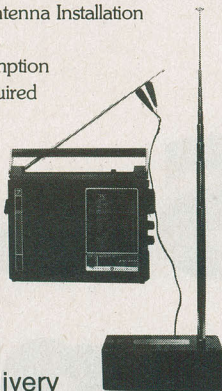
NEW IMPROVE SHORTWAVE RECEPTION FOR ONLY \$23.95!

E.O.C. ANTENNA & BOOSTER

- Eliminates Costly Antenna Installation
- No Extra Tuning
- Low Power Consumption
- No Grounding Required
- High Efficiency

ONE YEAR GUARANTEE ONLY \$23.95

Postage Paid Two Week Delivery



Electronic Overseas Corp., Inc.
214 E. Franklin Avenue, Midland Park, N.J. 07432

name _____

address _____

city _____

state _____

zip _____

NJ residents add 5% sales tax.

CIRCLE 78 ON FREE INFORMATION CARD

COMMUNICATIONS CORNER

continued from page 80

easier: simply adjust the slug of the IF transformer for the "cleanest" audio output from a received signal or a tone-modulated FM signal-generator. In fact, most inexpensive AM signal-generators have so much FM modulation that you can use an AM test-signal and adjust the transformer for the least-distorted sound between two peaks of a high-level (but distorted) tone.

You can convert the transmitter section of a transceiver using standard techniques. **(Editorial note: FM is illegal for CB use in this country. The conversion mentioned is for use by licensed radio amateurs in the appropriate amateur bands.)** The whole project should not cost more than \$25.00.

For you amateur-radio operators itching for something to build, consider converting an unused CB transceiver for 10-meter FM. For amateur use, FM works well. FM is essentially noise free, and the capture effect is an asset on the 10-meter band because the "breaking" procedure is not a problem for an experienced operator who is already used to pausing for a second or two before transmitting. The conversion shouldn't take more than a long weekend to complete.

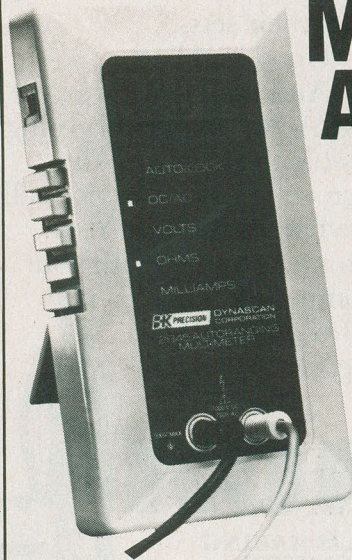
R-E

U.S. POSTAL SERVICE STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685)			
1. TITLE OF PUBLICATION RADIO-ELECTRONICS	2. NUMBER OF ISSUES 12	3. DATE OF FILING Oct. 1, 1981	4. ANNUAL SUBSCRIPTION PRICE \$13.00
5. COMPLETE MAILING ADDRESS OF KNOWN OFFICE OF PUBLICATION (Street, City, County, State and ZIP Code (not optional)) 200 Park Avenue South, New York City, NY 10003			
6. COMPLETE MAILING ADDRESS OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS (not optional) 200 Park Avenue South, New York City, NY 10003			
7. PUBLISHER (Name and Complete Mailing Address) Larry Steckler, 200 Park Avenue South, NYC, NY 10003			
8. EDITOR (Name and Complete Mailing Address) N. Harvey Gersback, 200 Park Avenue South, NYC, NY 10003			
9. MANAGING EDITOR (Name and Complete Mailing Address) Arthur Kleiman, 200 Park Avenue South, NYC, NY 10003			
10. FULL NAME Gersback Publications, Inc.		11. COMPLETE MAILING ADDRESS 200 Park Ave. So., NYC, NY 10003	
12. TYPE OF ORGANIZATION LITERATURE, BOOKS, ETC.		13. NUMBER OF COPIES OF THIS PUBLICATION 200 Park Ave. So., NYC, NY 10003	
14. IF KNOWN, BONDHOLDERS, MORTGAGEES, AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES OF PAPER OR OTHER MEDIA			
15. FOR COMPLETION BY NONPROFIT ORGANIZATIONS AUTHORIZED TO MAIL AT SPECIAL RATES (Section 4115, DMM 504) The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes: (Check one) <input type="checkbox"/> HAS NOT CHANGED DURING PRECEDING 12 MONTHS <input type="checkbox"/> HAS CHANGED DURING PRECEDING 12 MONTHS (If changed, publisher must submit explanation of change with this statement.)			
16. EXTENT AND NATURE OF CIRCULATION			
A. TOTAL NO. COPIES (Net Press Run)		283,958	
B. PAID CIRCULATION (Include copies of single copies ordered by subscribers)		72,854	
C. MAIL SUBSCRIPTION		128,356	
D. PAID DISTRIBUTION BY MAIL, CARRIER OR OTHER MEANS (Include copies of single copies ordered by subscribers)		203,210	
E. PAID DISTRIBUTION BY MAIL, CARRIER OR OTHER MEANS (Include copies of single copies ordered by subscribers)		7,002	
F. COPIES NOT DISTRIBUTED (Include copies of single copies ordered by subscribers)		208,252	
G. COPIES NOT DISTRIBUTED (Include copies of single copies ordered by subscribers)		2,958	
H. RETURN FROM NEWS AGENTS		71,738	
I. TOTAL (Sum of 16A through 16H)		283,958	
J. TOTAL (Sum of 16A through 16H)		296,352	
17. I certify that the statements made by me above are correct and complete. N. Harvey Gersback, Editor-in-Chief			

Support the
March of Dimes
BIRTH DEFECTS FOUNDATION



BK PRECISION



Microcomputer-Controlled Autoranging DMM Model 2845

- **Computer stabilized accuracy to 0.1%**
- **Auto-perfection**
Selects range for maximum resolution
- **Audible continuity indicator**
Built-in audible tone generator
- **G-MOV overload protection**
Provides AC and DC voltage range protection to 1000 VDC or AC peak
- **Shielded in RF fields**
Accuracy maintained in RF fields

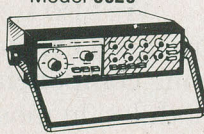
- **Long life, high reliability**
Four hermetically sealed reed relays perform range switching with virtually no contact wear.
- **Microcomputer intelligence**
Designed around 4-bit microcomputer. Analyzes stored data and range that provides greatest display resolution. Program memory capacity 1024 x 8 bits of ROM supported by 48 x 4 bits of data memory RAM

... in stock and available for immediate delivery.

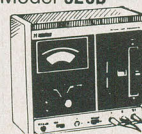
Dual Trace 5" 30 MHz Triggered Scope Model 1479A



Sweep/Function Generator Model 3020



Semiconductor Transistor Tester Model 520B



Portable Digital Capacitance Meter Model 820



Buy any of these instruments and get a FREE Bonus Gift!

Call for our prices TOLL FREE (800) 645-9518
in N.Y. State call (516) 752-0050

FORDHAM
855 Conklin St. Farmingdale, N.Y. 11735



- Master Charge
- BankAmericard
- VISA
- COD
- Money Order
- Check
- COD's extra

THANDAR'S COMPLETE PORTABLE TEST BENCH

LCD HAND HELD MULTIMETER

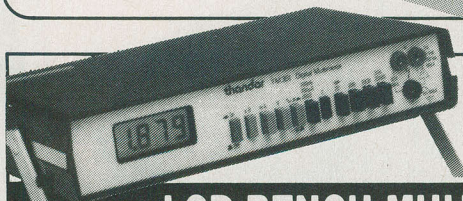
TM354 3½ Digit

● DC Volts : 1mV to 1000V ● AC Volts : 1V to 500V AC rms ● DC current : 1μA to 2A
● Resistance : 1Ω to 2MΩ ● Diode Check
● Basic accuracy : ± (0.75% of reading + 1 digit) ● Battery life : Typically 2000 hours

\$79.95



**2000 hrs
BATTERY
LIFE**



**4000 hrs
BATTERY
LIFE**

LCD BENCH MULTIMETERS

**\$199
inc. batts**

TM351 3½ Digit

● DC and AC Volts : 100μV to 1000V (750V AC rms)
● DC and AC current : 100nA to 10A (20A for 10 secs)
● Resistance : 100mΩ to 20MΩ ● Diode check ● Basic accuracy : ± (0.1% of reading + 1 digit) ● Battery life : up to 4000 hours

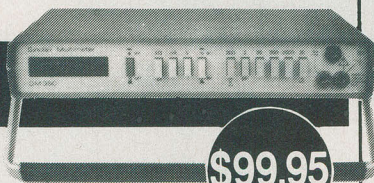
TM353 3½ Digit

● DC and AC Volts : 100μV to 1000V (750V AC rms) ● DC and AC current : 100nA to 2A
● Resistance : 1Ω to 20MΩ ● Diode check ● Basic accuracy : ± (0.25% of reading + 1 digit) ● Battery life : Typically >3000 hours ● \$159 (inc. batts).

LED MULTIMETERS

DM350 3½ Digit;

34 ranges; 0.1% basic accuracy;



\$99.95

DM235 3½ Digit; 21 ranges; 0.5% basic accuracy; \$69.95

PDM35 3½ Digit; Hand held; 16 ranges; 1% basic accuracy; \$39.95



\$159

PULSE & FUNCTION GENERATORS

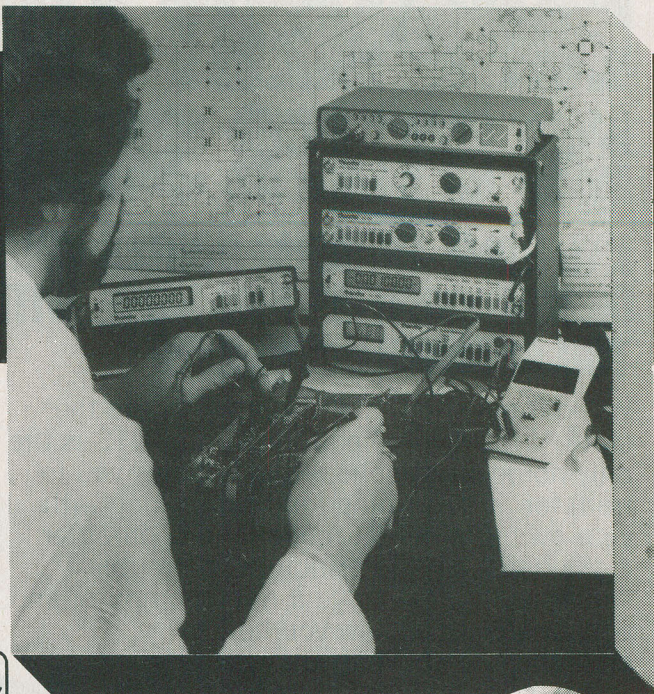
TG100 100kHz Function Generator

● Frequency range : 0.1Hz to 100kHz
● Functions : Sine, Square, Triangle and DC from variable 600Ω output ● Output range : 1mV-10V peak-peak ● DC offset range : ±5V ● TTL output ● External sweep : ≥300:1 linear range

STOP PRESS TG102 2MHz Function Generator \$299

TG105 5MHz Pulse Generator

● Period : 200nsec to 200ms (5MHz to 5Hz) ● Pulse width : 100nsec to 100ms ● 50Ω output range : 0.1V-10V ● TTL output ● Sync. output ● Operating modes : run, external trigger, external gate, manual 1-shot or gate ● Complement and square wave ● \$199



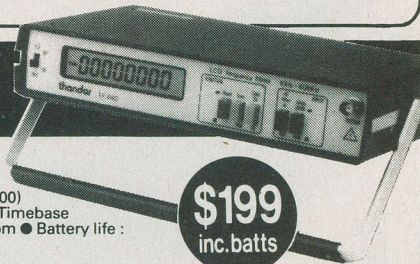
GOLD MEDAL WINNER

\$259

SC110 SINGLE TRACE LOW POWER 2" OSCILLOSCOPE

This truly portable oscilloscope, the only British product to win a Gold Medal at the 1980 Brno Trade Fair, boasts the following specification: ● Bandwidth : DC to 10MHz ● Sensitivity : 10mV/div to 50V/div ● Sweep Speeds : 0.1μsecs/div to 0.5 secs/div ● Power Requirements : 4 to 10V DC from 4 'C' cells or AC adaptor ● Size and weight : 255 x 150 x 40mm; 800gms excl. batteries

FREQUENCY METERS



**\$199
inc. batts**

TF040 8-Digit LCD

● Frequency Range : 10Hz-40MHz (to 400MHz with TP600)
● Sensitivity : 40mV rms ● Timebase accuracy : better than 0.5 ppm ● Battery life : Typically 80 hours

TF200 8-Digit LCD

● Frequency Range : 10Hz-200MHz (to 600MHz with TP600) ● Sensitivity : 10mV rms 20Hz-100MHz, 30mV rms 10Hz-20Hz, 100MHz-200MHz ● Timebase accuracy : better than 0.3 ppm ● Battery life : Typically 200 hours ● \$299 (inc. batts).

PFM200 8-Digit LED Hand Held Meter

● Frequency Range : 20Hz-200MHz (to 600MHz with TP600) ● Sensitivity : Typically 10mV ● Timebase accuracy : better than 2 ppm ● Battery life : Typically 10 hours ● \$99.95

TP600 600MHz Prescaler

● Frequency Range : 40MHz to 600MHz ● Sensitivity : 10mV ● Output : Typically 500mV peak-peak ● \$79

THANDAR SATISFACTION WARRANTY:

If for any reason, whatsoever, you are not completely satisfied with your purchase, return it within 30 days of purchase date for a full refund - it's as simple as that!

TO ORDER CALL TOLL FREE: 800-526-5311
We accept Master Charge or Visa

New Jersey Residents add appropriate Sales Tax. Prices shown in U.S. currency only.

POSTAGE AND HANDLING up to \$100 add \$3. Over \$100 add \$5.

THANDAR ELECTRONICS INC

P.O. Box 8247, Haledon, New Jersey, 07538 Tel: 201-790-3141

CIRCLE 48 ON FREE INFORMATION CARD

EQUIPMENT AND TRAINING NO OTHER SCHOOL CAN MATCH.

NTS HOME TRAINING INVITES YOU TO EXPLORE MICROCOMPUTERS, DIGITAL SYSTEMS AND MORE, WITH STATE-OF-THE-ART EQUIPMENT YOU ASSEMBLE AND KEEP

Without question, microcomputers are the state of the art in electronics. And NTS is the only home study school that enables you to train for this booming field by working with your own production-model microcomputer.

We'll explain the principles of troubleshooting and testing your microcomputer and, best of all, we'll show you how to program it to do what you want.

You'll use a digital multimeter, a digital logic probe and other sophisticated testing gear to learn how to localize problems and solve them.

Send for the full color catalog in the electronics area of your choice—discover *all* the advantages of home study with NTS!

NTS also offers courses in Auto Mechanics, Air Conditioning and Home Appliances. Check card for more information.



We believe that training on production-model equipment, rather than home-made learning devices, makes home study more exciting and relevant. That's why you'll find such gear in most of NTS's electronics programs.

For instance, to learn Color TV Servicing you'll build and keep the 25-inch (diagonal) NTS/HEATH digital color TV.

In Communications Electronics you'll be able to assemble and keep your own NTS/HEATH 2-meter FM transceiver, plus test equipment.

But no matter which program you choose, NTS's Project Method of instruction helps you quickly to acquire practical know-how.



Simulated TV Reception

4.

3.

1. The NTS/Rockwell AIM 65

Microcomputer A single board unit with on-board 20 column alphanumeric printer and 20 character display. A 6502-based unit 4K RAM, expandable.

2. The NTS/KIM-1

Microcomputer A single board unit with 6 digit LED display and on-board 24 key hexadecimal calculator-type keyboard. A 6502 based microcomputer with 1K RAM, expandable.

3. The NTS/HEATH H-89 Microcomputer

features floppy disk storage, "smart" video terminal, two Z80 micro-processors, 16K RAM memory, expandable to 48K.

4. The NTS/HEATH GR-2001 Digital Color TV (25" diagonal) features specialized AGC-SYNC muting, filtered color and new solid-state high voltage tripler rectifier.

NTS NATIONAL TECHNICAL SCHOOLS

TECHNICAL-TRADE TRAINING SINCE 1905
Resident and Home-Study Schools
4000 SO. FIGUEROA ST., LOS ANGELES, CA. 90037

NATIONAL TECHNICAL SCHOOLS

4000 South Figueroa Street,
Los Angeles, California 90037

Dept. 206-121

Please rush FREE: color catalog on course checked below

- ☐ MicroComputers/MicroProcessors
- ☐ Communications Electronics
- ☐ Digital Electronics
- ☐ Industrial Technology

- ☐ Auto Mechanics
- ☐ Air Conditioning
- ☐ Home Appliances
- ☐ Color TV Servicing

Name _____ Age _____

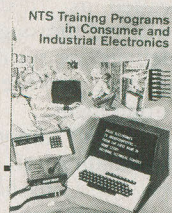
Address _____

Apt. _____ City _____

State _____ Zip _____

☐ Check if interested in G.I. information.

☐ Check if interested ONLY in classroom training in Los Angeles.



COMPUTER CORNER

What software is, and what it does.

LES SPINDLE*

IN THE MOST GENERAL SENSE, SOFTWARE is what you need to get a computer to perform its intended function. Software can be recorded on the printed page, on cassette, or on disk. Reading the data off a page and feeding it manually into the machine (most commonly via a typewriter-like keyboard like the one shown in Fig. 1) is also the most time-consuming method. Feeding the data into the computer's memory from a pre-recorded cassette or disk is a much more efficient process.

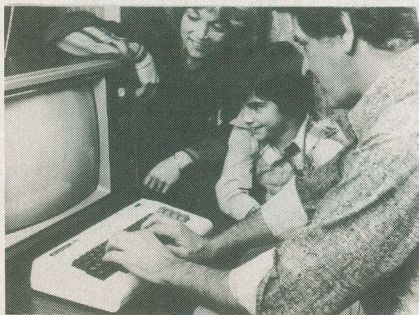


FIG. 1

The computer user's first encounter with software is usually the documentation supplied with the hardware. Operating procedures, the user's manual, tips on the particular language syntax—and all the other information needed to prepare the machine for operation—is classified as "documentation." How clearly and thoroughly the step-by-step guidelines are set down will determine how successful the user is in operating the equipment.

Of special importance is the user's understanding of the computer language(s) used by his or her equipment. Just as people have devised physical sounds to represent objects, actions, and ideas, computers must have methods of accepting symbols that can be understood in order to be processed as data. Humans communicate by producing symbols (words) with their voices; the computer communicates by using symbols in the form of electrical impulses. And, just as humans have devised letters to convey their language on the printed page, a computer language needs to have its own set of

symbols that can be read and understood by the user. When the user punches the various symbols on a keyboard, the computer translates the symbols into the electrical signals that tell the computer which function it is to perform.

Just as there are many different languages spoken around the world, there are many different computer languages. The most basic, machine language, is a rudimentary method of communicating directly to the computer through a system of binary digits. All computers have electronic circuits designed to detect voltage levels designated as 1's or 0's. Those are coded to represent a set of instructions.

The instruction codes are built into the microprocessor, or central processing-unit (CPU), and are usually different for each type of microprocessor. By inputting data using the machine's elemental binary language, communication is possible; but the process is long, tedious, and undesirable for efficient use of the computer.

One of the major problems with using machine language is that every computer instruction is a long string of 1's and 0's. To make those instructions more understandable, assembly languages were devised. Those languages made it easier to work with computers by assigning a name or "mnemonic" to each instruction.

While assembly language is easier to use than machine language, it is still machine-dependent, and programming with it is still a long and tedious process. That is why various high-level languages were developed; they allow the user to work in a language that is closer to English, thus improving efficiency and simplifying communications. Those languages include BASIC, Fortran, Cobol, and Pascal.

BASIC (*B*eginners *A*ll-Purpose *S*ymbolic *I*nstruction *C*ode), the most widely used and familiar language, is easy to learn because of its English-like statements and simple syntax. It is used in business and commercial applications, as well as for education. In BASIC, each line begins with a number that identifies it and specifies the order in which the statements are to be performed. The computer does the sorting

of the program before it is run, so statements do not need to be input in any particular order.

Fortran (*F*ORMula *T*RANSlation) is used most commonly for mathematics, engineering, and science problems. Cobol (*C*OMmon *B*USINESS *O*riented *L*anguage) is used most often in business and data-processing applications. Like BASIC, its format is simple and understandable for those with little technical knowledge. Pascal, named after the 18th century French mathematician Blaise Pascal, was developed in 1970 by Nilus Wirth of Zurich, Switzerland, to alleviate the burden of long lists and cumbersome sequential processes required by BASIC. It standardizes the language structure, making it easier for one person to understand programs written by others. It is used in a rapidly growing number of applications.

As important as the language is the choice of an operating system. Essentially an "agent" between the hardware, the software, and the user, an operating system is a set of programs that manage collectively all of the resources available to the computer—including the CPU, the peripheral devices, and the software. For example, few users would be able to tell a disk drive to pick a track and sector to write data on. The file-management system will handle that task.

One advantage of an operating system is software compatibility. Software written in a high-level language is usually designed to interface to an operating system, which then interfaces to the hardware. Such software is easy to adapt to different hardware configurations—and even to a different computer entirely, as long as the operating system is the same.

An operating system is essential for the user who plans to write his or her own programs, as it provides a number of utility programs that make the development of application programs faster and less expensive. The primary duties of an operating system can be divided into four main categories. The first is file and software management. The system will include a large library of programs and files generally needed

continued on page 90

*Associate Editor, Interface Age Magazine

EAST/WEST

INTERTEC SUPERBRAIN 64K RAM	\$2799
QD SUPERBRAIN	\$2999
NEC 5510 SPINWRITER (7710)	\$2345
NEC 5520 SPINWRITER (7720)	\$2695
NEC 5530 SPINWRITER (7730)	\$2345
NEC 12" MONITOR	\$ 229

We accept
C.O.D.'s •
Stock Shipments
Same Day or Next • No
surcharge for Credit Cards

Ω OMEGA SALES CO.

All Equipment Factory
Fresh w/MFT Warranty
We carry the
complete line of
Personal
Software

OKIDATA MICROLINE-80	\$ 399
OKIDATA MICROLINE-82	\$ 529
OKIDATA MICROLINE-83	\$ 769
DIABLO 630	\$1995
APPLE II PLUS 48K	\$1139
APPLE DISK w/3.3 DOS Controller	\$ 525
APPLE DISK w/o Controller	\$ 449
HAZELTINE 1420	\$ 799
NORTHSTAR HORIZON II 32K QD	\$2925
ANADIX DP-9500/9501	\$1249
TELEVIDEO 912C	\$ 669
TELEVIDEO 920C	\$ 729
TELEVIDEO 950	\$ 929
CBM 8032 COMPUTER	\$1149
CBM 8050 DISK DRIVE	\$1349
CBM 4032 COMPUTER	\$1029
CBM 4040 DISK DRIVE	\$1029
CBM 4022	\$ 649
CBM VIC-20	\$ 269
LEEDEX/AMDEK 100	\$ 139
LEEDEX/AMDEK 100G	\$ 169
LEEDEX/AMDEK COLOR-1 13" Color Monitor	\$ 329
MICROTEK 16K RAMBOARD for Atari	\$ 79
MICROTEK 32K	\$ 149

EAST COAST
1-800-556-7586



WEST COAST
1-800-235-3581

PRICES ARE SUBJECT TO
CHANGE WITHOUT NOTICE.



CHRISTMAS SPECIALS!

**FREE
GOLD!**

\$749

Good thru
Dec. 15



**Buy an ATARI 800 16K and
receive a 14K Gold Bracelet
FREE!!**

(Actual size
Genuine 14K 24.95 retail)

ATARI SPECIALS

ATARI 400

16K Personal Computer

\$349

ATARI PERIPHERALS

410	Program Recorder	\$ 60
810	Disk Drive	\$449
820	40 Column Printer	\$299
822	40 Column Thermal Printer	\$349
825	80 Column Printer	\$599
830	Acoustic Modem	\$159
850	Interface Module	\$139

ATARI ACCESSORIES

CX852	8K RAM Memory Module	\$39.95
CX853	16K RAM Memory Module	\$89.95
CX30-04	Paddle Controller (pair)	\$15.00
CX40-04	Joystick Controller (pair)	\$15.00

With any purchase of ATARI Hardware or Software over \$500
you can buy the bracelet for only \$9.95.

WE CARRY THE COMPLETE LINE OF ATARI SOFTWARE.
CALL FOR THE SUPER CHRISTMAS SAVINGS!!!

WEST COAST
1-800-235-3581

OMEGA SALES CO.
3533 Old Conejo Rd. #102
Newbury Park, CA 91320
1-805-499-3678
CA. TOLL FREE 1-800-322-1873



EAST COAST
1-800-556-7586

OMEGA SALES CO.
12 Meeting St.
Cumberland, RI 02864
1-401-722-1027

OMEGA SALES CO.
CIRCLE 68 ON FREE INFORMATION CARD

COMPUTER CORNER

continued from page 88

by the user. Upon request by the user, the system will retrieve the desired program from disk and bring it into main memory for immediate accessibility.

A second important function is managing input/output devices and peripherals—printers, terminals, etc. When writing a program, the user only needs to be concerned with what he wishes to do with a given peripheral device; the operating system will provide the desired code. That greatly reduces the time it would take to develop routines

to communicate with the peripherals.

Third: the system will manage the computer's memory. The transfer of programs into and out of memory is done automatically; the system determines where the program is to be stored in memory.

Finally, but certainly not least important, the system works as a sort of taskmaster for the CPU. Since the CPU performs all of the arithmetic and logic functions, and routes all of the data through the computer, it is a very busy part of the machine. The operating system controls the CPU at all times, and assigns new tasks instantly when it detects that the CPU is sitting idle. That is

less essential, perhaps, in a one-user system or a very small business; but in demanding situations, it is the quickest and most efficient way to accomplish the tasks at hand.

Several operating systems have become standards in the computer industry, but the most widely used, by far, is CP/M (Digital Research). It is compatible with 8080 or Z80 microprocessors using the S-100 bus, or the Intel MDS system. It is also licensed to almost all computer manufacturers that build disk systems for 8080 and Z80 microprocessors.

It comes on diskette in two versions; both include the license to use it, six manuals, an editor, an assembler, and a debugging program. It is adaptable to a wide range of disk systems and computers. It supports a wide range of high-level language and assembly-language programs, including word-processing systems, data-base management systems, sort programs, and virtually any other type of applications software.

Other well known and popular systems include MP/M (Digital Research), a multiuser, multiterminal disk operating-system also for the 8080 and Z80; Oasis (Phase One Systems) for the Z80; Tenpos (Administrative Systems) for the 8080 and Z80; Flex (Technical Systems Consultants) for 6800-based systems using the SS-50 bus; Amos (Alpha Micro Systems) for the Alpha Micro AM-100 16-bit system, and TRSDOS (Radio Shack) for the TRS-80 series of computers.

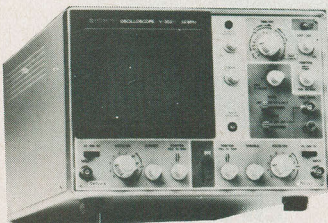
After the operating system, language, and documentation are in order, you are ready to select the applications software to run on your machine. As noted in the first column of this series, the range of applications software is enormous: educational programs, games, accounts receivable, general ledger, payroll, word-processing, inventory control, filing, record keeping—and almost anything else you can think of.

The choice at this point is whether to buy commercially available software or to custom-design your own. Although the thought of custom programs designed precisely to fit your individual needs is tempting, and seems a logical way to proceed at first, the cost is often prohibitive. The labor costs in developing such programs can be astronomical. When you (or your employees in a business situation) are first getting to know your computer, it is probably best to begin with some good commercial packages. Later, as you become more and more familiar with your computer and how it works, it may become feasible to put some energy and expense into custom-tailoring programs to fit your needs.

continued on page 106

**ADVANCE IS PROUD
TO INTRODUCE
The HITACHI Line
of High Quality Oscilloscopes
All Hitachi Instruments
Are Backed by
A Two-Year Warranty**

**Hitachi Oscilloscope V-302 B
DC-30MHz dual-trace**



1. TV sync-separator circuit
2. High-sensitivity 1mV/div (5MHz)
3. Signal delay line
4. X-Y operation
5. Sweep-time magnifier (10 times)
6. Trace rotation
7. Z-axis input (Intensity modulation)

**ADVANCE
ELECTRONICS**

**THE TEST EQUIPMENT
SPECIALISTS**

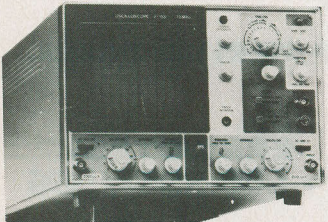
**TOLL FREE HOT LINE
800-223-0474**



54 WEST 45th STREET,
NEW YORK, N.Y. 10036 212-687-2224



**Hitachi Oscilloscope V-152 B
DC-15MHz dual-trace**



1. TV sync-separator circuit
 2. High-sensitivity 1mV/div (5MHz)
 3. X-Y operation
 4. Sweep-time magnifier (10 times)
 5. Trace rotation
 6. Z-axis input (Intensity modulation)
- (Also available in single-trace)

HITACHI V-302 B & V-152 B

- TV sync-separator circuit facilitates rapid video signal measurement.
- Extra-high sensitivity; vertical sensitivity of 1mV/div. now available.
- Built-in signal delay line for leading edge observation of quick-rising waveforms (V-301 and V-302).
- X-Y operation very convenient for measuring phase difference of two waveforms.
- Sweep-time magnifier effective for precise measurement; sweep time magnifying 10 times with one-touch operation.
- Trace rotation system for easily adjusting bright-line inclination caused by terrestrial magnetism.
- Z-axis input provided-possible to use as CRT display.
- 0.2μs~0.2s-wide sweep range setting.
- One-touch shifting waveform slopes.
- Five modes of vertical deflection operation (Type V-152 and V-302).
- Panel layout with color-coding of respective functions.

Put a proven Hitachi dual-trace oscilloscope on your bench for as little as \$695. Our V-152 15MHz model includes unprecedented sensitivity (1 mV/div)...10X sweep magnification...front panel XY operation...trace rotation...Z-axis input...and more. Need greater bandwidth? Our V-302 model is the only 30MHz dual-trace scope with signal delay line priced under \$1000, with all the above features, to make your testing operations fast, easy, and accurate. Reliability is exceptional too. (As you'd expect from a manufacturer with over 20 years of experience "outscoping" the competition.) So exceptional, in fact, that Hitachi quality is backed by a 2-year warranty...the longest in the industry. Whether you use it for teaching or repairs, for video, audio, or computer testing, you can't find more scope for your dollar than at Hitachi. Call for more details.

V-151B 15 MHz Single Trace
V-152B 15 MHz Dual Trace
V-202 20 MHz Dual Trace
V-301 30 MHz Single Trace
V-302B 30 MHz Dual Trace

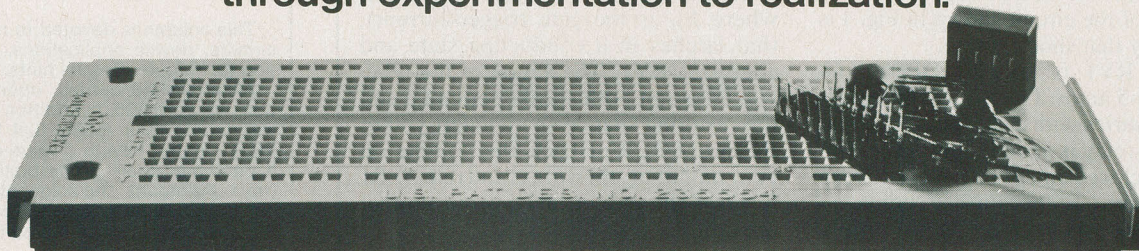
V-352 35 MHz Dual Trace
V-550B 50 MHz Dual Trace,
Dual Time Base
V-1050 100 MHz Dual Trace,
Dual Time Base

**Call For
Special Intro
Price Offer**

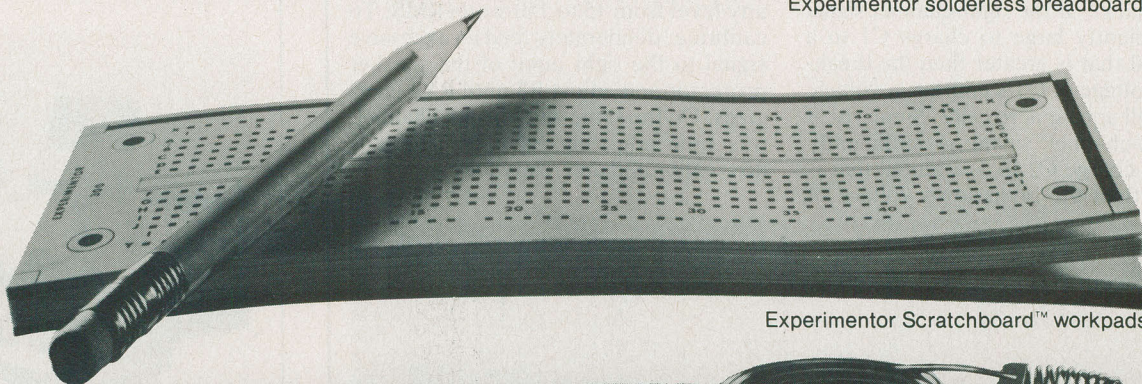
**Hitachi...The measure
of quality.**

You can't beat The System.

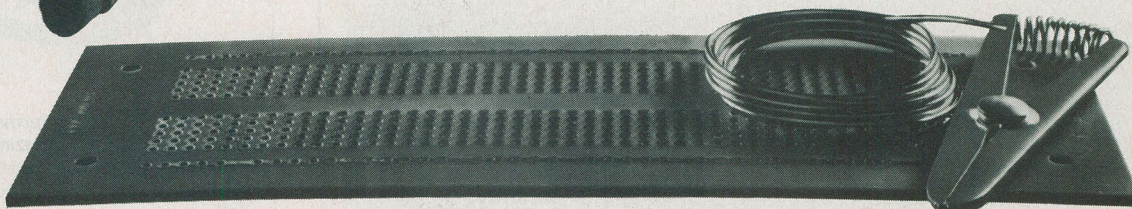
The Experimentor System™ —a quicker transition from imagination through experimentation to realization.



Experimentor solderless breadboard.



Experimentor Scratchboard™ workpads.



Experimentor Matchboard™ pre-drilled PCBs.

When you have a circuit idea that you want to make happen, we have a system to make it happen quicker'n'slicker'n ever before: The Experimentor System.

You already know how big a help our Experimentor solderless breadboards can be. Now we've taken our good idea one step farther. Twice.

We've added Experimentor Scratchboard workpads, with our breadboard hole-and-connection pattern printed in light blue ink. To let you sketch up a layout you already have working so you can reproduce it later.

With Experimentor Matchboard you can go from breadboard to finished nonstop! We've matched our breadboard pattern again, this time on a printed circuit board, finished and ready to build on. All for about \$2.70*.

There's even a letter-and-number index for each hole, so you can move from breadboard (where they're molded) to Scratchboard™ (where they're printed) to Matchboard™ (where they're silkscreened onto the component side) and always know where you are.

When you want to save time and energy, you can't beat The Experimentor System.

Smarter tools for testing and design.

70 Fulton Terr., New Haven, CT 06509 (203) 624-3103, TWX 710-465-1227
OTHER OFFICES: San Francisco (415) 648-0611, TWX 910-372-7992
Europe: Phone Saffron-Walden 0799-21682, TLX 817477
Canada: Len Finkler Ltd., Downsview, Ontario

**GLOBAL
SPECIALTIES
CORPORATION**

Call toll-free for details
1-800-243-6077
During business hours

*Suggested U.S. resale. Prices, specifications subject to change without notice. © Copyright 1981 Global Specialties Corporation.

CIRCLE 57 ON FREE INFORMATION CARD

NEW IDEAS

Speaker overload protector

MANY OF THE LOWER-PRICED AMPLIFIERS available today do not provide any overload protection for your speakers. The purpose of the circuit shown in Fig. 1 is to remedy that shortcoming.

Relay RY1 is six-volt DPDT unit rated at 3-5 amps. One set of contacts is wired in series with each speaker so that when the relay is *not* energized, the contacts are closed and the circuits between the speakers and the amp are complete.

The input to the circuit is taken from your amplifier's speaker-output terminals or jacks. If the right-channel signal is sufficiently large to charge C1 to a potential that is greater than the breakdown voltage of Q1's emitter, a voltage pulse will appear across R7. Similarly, if the left-channel signal is sufficiently large to charge C2 to a potential that is greater than the breakdown voltage of

Q2's emitter, a pulse will appear across R7. The pulse across R7 triggers SCR1, a sensitive gate SCR ($I_{GT} < 15 \text{ mA}$, where I_{GT} is the gate trigger-current), that latches in a conducting state and energizes RY1. The action of the relay will interrupt both speaker circuits, and the resulting silence should alert you to the problem. Cut back the volume on your amplifier, then press and release S1 to reset the circuit and restore normal operation.

The circuit can be adjusted to trip at any level from 15 to 150-watts RMS. To calibrate, deliberately feed an excessive signal to the right input of the speaker protector and adjust R3 until RY1 energizes. Do the same with the left channel, this time adjusting R4. The circuit is now calibrated and ready for use.

—Willie Ward

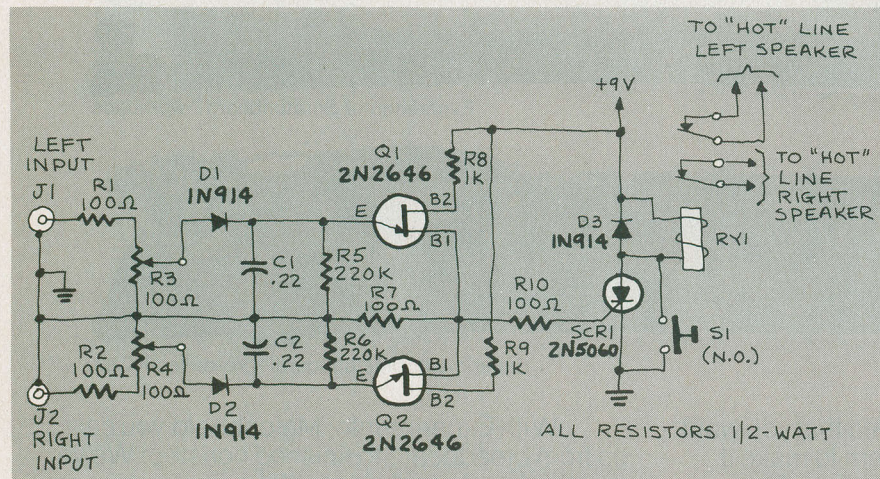
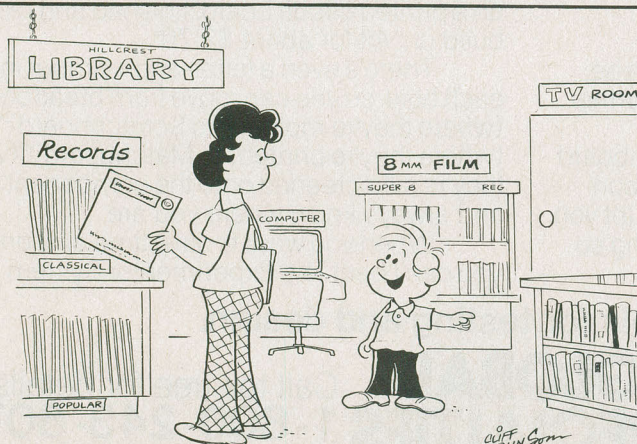


FIG. 1

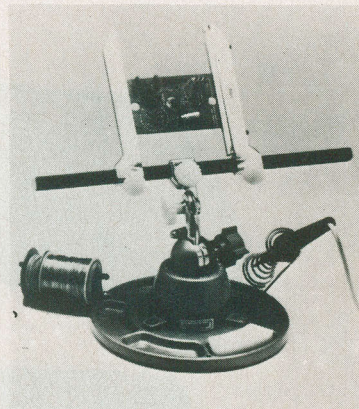


"Look, Mom—They've got books here, too!"

NEW IDEAS

This column is devoted to new ideas, circuits, device applications, construction techniques, helpful hints, etc.

All published entries, upon publication, will earn \$25. In addition, Panavise will donate their model 324 Electronic Work Center, having a value of \$49.95. It combines their circuit-board holder, tray base mount, and solder station (see photo below). Selections will be made at the sole discretion of the editorial staff of **Radio-Electronics**.



I agree to the above terms, and grant **Radio-Electronics** Magazine the right to publish my idea and to subsequently republish my idea in collections or compilations of reprints of similar articles. I declare that the attached idea is my own original material and that its publication does not violate any other copyright. I also declare that this material had not been previously published.

Title of Idea

Signature _____

Print Name _____

Date _____

Street

City

State

ZIP

Mail your idea along with this coupon to: **New Ideas Radio-Electronics, 200 Park Ave. South, New York, NY 10003**

TOYS FOR THE HOLIDAYS

continued from page 54

laying-out the circuit is not to route the output of IC1 near the input to that IC. If possible, use a 100-mA current-limited power-supply in place of battery B2 while adjusting the circuit; doing that will protect transistors Q5 and Q6, and prevent draining the battery.

The first thing you'll need to do is to find the proper value for R3. Start by shorting Q1's collector to ground. Then, increase the value of R3 until the current drain from the power supply is less than 60 milliamperes. When that is done, remove the short from Q1.

To see if the device is operating properly, close switch S1 and reduce the resistance of R11. Wait 10 seconds, then rotate R11 slowly, and you should hear a sound similar to that of a steam locomotive picking up speed.

There you have it—four simple toys that any child would enjoy. We have built several of each and submitted them to some very tough "critics"—several children that we know! The results were very positive!

R-E

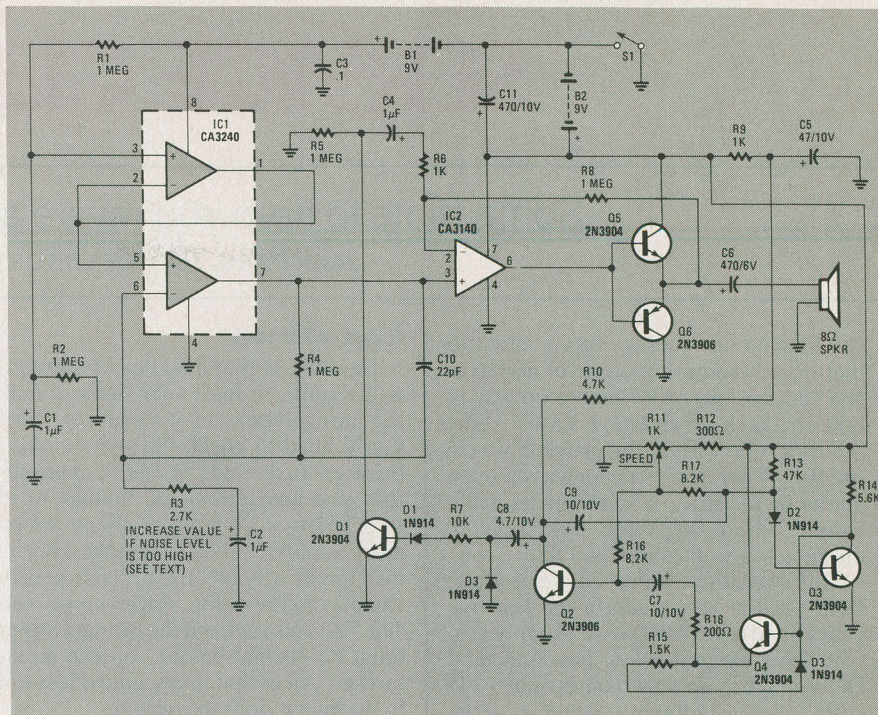


FIG. 4—THE CHUG-CHUG TOY simulates the sound of a steam locomotive. A dual MOSFET-input op-amp, IC1, is used as a white noise generator in this circuit.

PARTS LIST—CHUG-CHUG

Resistors, 1/4 watt, 5%, unless otherwise noted

R1, R2, R5, R8—1 megohm
R3—2700 ohms
R6, R9—1000 ohms
R7—10,000 ohms
R10—4700 ohms
R11—1000 ohms, potentiometer, linear taper
R12—300 ohms
R13—47,000 ohms
R14—5600 ohms
R15—1500 ohms

R16, R17—8200 ohms
R18—200 ohms

Capacitors

C1, C2, C4—1 μ F, 10 volts or higher, electrolytic
C3—0.1 μ F, Mylar or ceramic disc
C5—47 μ F, 10 volts or higher, electrolytic
C6—470 μ F, 6 volts or higher, electrolytic
C7, C9—10 μ F, 10 volts or higher, electrolytic
C8—4.7 μ F, 10 volts or higher, electrolytic
C10—22 pF, mica or ceramic disc
C11—470 μ F, 6 volts or higher, electrolytic

Semiconductors

D1-D3—1N914 or equivalent silicon diode
IC1—CA3240 (RCA) or equivalent dual op-amp
IC2—CA3140 (RCA) or equivalent op-amp
Q1-Q5—2N3904, 2N2222, or equivalent NPN transistor
Q6—2N3906 or equivalent PNP transistor
B1, B2—9-volt battery, transistor-radio type
S1—SPST switch
Miscellaneous: Wire, solder, miniature 8-ohm speaker, etc.

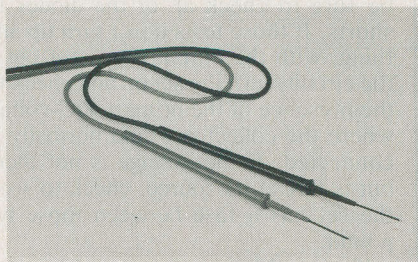
Radio-Electronics

mini-ADS

CALL AND RESERVE YOUR SPACE

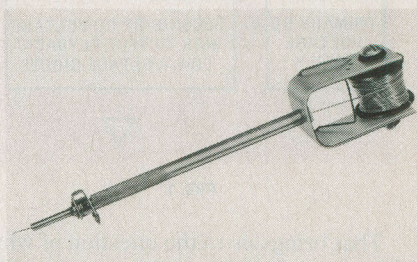
- \$550 for a 6X frequency insertion.
- Reaches 211,387 readers.
- Fast reader service cycle.
- Short lead time for the placement of ads.
- We typeset and layout the ad at no additional charge.

Call 212-777-6400 to reserve space. Ask for Arline Fishman. Limited number of pages available. Mail materials to: mini-ADS, RADIO-ELECTRONICS, 200 Park Ave. South, New York, NY 10003.



AT LAST! COMPLETELY REPAIRABLE TEST PROBES. MICROPROBES from Huntron Instruments feature a needle-sharp stainless steel point on a telescoping, length adjustable electrode insulated to withstand 1KV right down to the ground tip. Super-Slim valox probe bodies and 5 foot superflex leads. **All parts are replaceable! \$9.95 + \$3.50 handling.** Add CALIF. or WASH. tax. **Visa/Mastercharge accepted.** Huntron Instruments, 15123 Hwy. 99 North-Lynnwood, WA 98037 (800) 426-9265.

CIRCLE 16 ON FREE INFORMATION CARD



Faster and easier wrapping with **P184-5 Slit-N-Wrap** wire wrapping tool. Eliminate hand held wire end at wrap start with new wire grip housing. Tension regulator on wire spool reduces wire breakage. No stripping. No precutting. No premeasuring. No loading. Daisy chain wraps. Comes with quick change bit and two 50' spools Tefzel wire. **\$44.00 ea.** Vector Electronic Company, 12460 Gladstone Ave., PO Box 4336, Sylmar, CA 91342, (213) 365-9661, TWX 910-496-1539.

CIRCLE 15 ON FREE INFORMATION CARD

SERVICE CLINIC

Some hints to help you revive a "dead" set.

JACK DARR, SERVICE EDITOR

IT USED TO BE THAT A "DEAD" SET (NO picture, no sound) was one of my favorite service jobs. All I had to do was to take the back off and have a look. If the rectifier tube was lit, the problem was in the B+; if not, the problem was an open choke or resistor, or something equally simple. The whole thing took about 10 minutes to troubleshoot and fix.

Unfortunately, those days are gone. Many of the sets made in the last five years or so use a dual power-supply system. That system has a line-connected DC-voltage supply with outputs of +145 volts using a half-wave rectifier, +250 volts with a full-wave bridge, +300 volts with a half-wave doubler, and so on.

That line-connected, or primary, supply provides the operating primary for the secondary DC-supply system, including the flyback transformer and the horizontal-output transistor. The secondary supply provides the actual operating voltages for the rest of the set. It also serves to isolate the chassis from the AC power-line. Windings on the flyback provide pulses that are rectified and filtered to obtain the DC voltages for all the signal circuits and even the picture-tube heaters. A block diagram of the power-supply circuit is shown in Fig. 1.

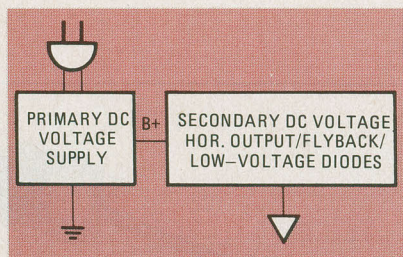


FIG. 1

That brings us to the question of why this type of power supply is more difficult to service than the older ones. Instead of only one ground, we now have two. One of the grounds is used for the line-connected primary DC supply, and is often common to the AC-line ground side. The other ground is isolated, and is used for all of the other circuits. That eliminates any possibility of a shock from touching the metal parts of the cabinet.

A two-step test

Because of that dual power-supply, it will require at least two steps to make the initial tests on a dead set. First, you'll need to check the switch, circuit breaker, fuse, and the rest to make sure that you are getting AC voltage to the set. Then you'll have to check the primary supply. If the DC voltage from it is missing or way off, the procedure is the same as in the older, single-supply sets. The DC voltage from the primary supply must be normal before you can go any farther. All of that takes almost less time to do than it does to explain.

The second step is to check the secondary supply—the voltages coming from the flyback. If the voltage for the picture tube's heaters comes from the flyback, that step is easy. If the heaters are lit, the flyback/output-transistor circuit is working. If that is the case, your trouble could be in one of the low-voltage supplies, and that could be killing a vital stage. If none of the flyback-derived DC voltages are present, turn off the set and check the horizontal-output transistor. If that transistor is open, it could be the cause of your problems. Do *not* substitute a good transistor and turn the set on. There may be a dead short elsewhere in the set that blew that transistor. (If that is the case, you'll wind up with *two* very dead, very expensive power-transistors!)

Make continuity and resistance tests on the low-voltage DC-supply circuits; be sure to check all of the diodes for shorts. If those tests don't turn up anything, with the output transistor out of the circuit, turn the set on and check for the presence of the primary DC-voltage where the collector would normally be connected. If the voltage is not there, but is OK at its source, check to see if the set has a fuse between those two points.

If everything seems to check out in the output stage, again leave the output transistor out and check the horizontal-oscillator stage. That stage generally has a "starter" circuit that feeds a small pulse of DC to get the oscillator going. Once it starts, it drives the output transistor, which then gets its power from the low-voltage windings of the flyback. To test the starter circuit, turn the set on; if the oscillator does not start, feed a DC

voltage (from a bench supply) equal to the normal output of the starter circuit to that circuit's DC output-point. If the oscillator starts and the set works normally, the problem lies in the starter circuit.

There are several different starter circuits around; check your schematic to see which one you have. One interesting circuit uses the high pulse of charging current that flows into the input filter-capacitor at turn-on; that pulse is passed through the primary winding of a transformer. The changing current in the primary induces a pulse in the secondary, and that is rectified, filtered, and then used as the starter pulse. When the filter capacitor is fully charged, and the current no longer changes, the circuit becomes inoperative.

Watch those grounds

When testing any dual-supply circuits, check the schematic to make sure of which ground you should be using. The dual-ground system has brought back a symbol that used to be quite common in AC/DC radios. The standard ground symbol is a triangle of horizontal lines; the isolated-ground symbol is a hollow triangle (see Figs. 2-a and -b). The service data should tell you which parts of the chassis are connected to which ground. Using the wrong ground can give you some very strange readings, but is of no help at all in finding the problem. Not too long ago, we were checking a video-amplifier stage with an oscilloscope and found a sound signal on it! It turned out that we were using the wrong ground.

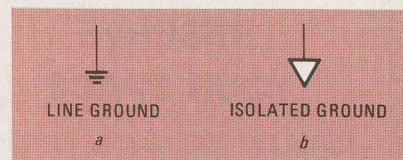


FIG. 2

One note of caution: If the set that you are working on uses a full-wave bridge rectifier that is directly across the AC line, the chassis will *always* be hot—at least 60-volts AC. If the grounds of some of your test equipment are returned to the line ground, you can damage the set or your equipment just by

hooking up the ground lead. Always use an isolation transformer for safety when you are working on those sets. In fact, it's not a bad idea to use an isolation transformer on any dual-ground set.

In cases where the trouble is not an open circuit, but rather a short (indicated by a blown fuse or tripped circuit-breaker), you should make several tests before turning the set on. Check the resistance to ground from the primary supply; also check for shorted rectifiers, etc. If that is OK, check from the DC supply to the collector of the horizontal-output transistor, from its collector to ground, and also check the transistor for shorts. You can pull the transistor and apply primary power. If the short "disappears," the problem is either a shorted output-transistor or a short in one of the low-voltage supplies from the flyback.

A variable-output transformer can also be handy when you are looking for shorts. If the output transistor is OK, or if you have put in a new one, place an ammeter in series with the primary DC supply, and a voltmeter across it. Start the transformer with a very low line-voltage, and bring it up *very* slowly. Watch the ammeter; if the current is normally 500 mA, and you see 300-350 mA when the supply voltage is just $\frac{1}{3}$ of normal, you still have a problem. The short is still there, but the low voltage

holds down the power dissipation and keeps the transistor from blowing. You can also use a variable-output transformer to make some DC-voltage tests around the circuit. If you are using $\frac{1}{3}$ of the normal supply voltage, look for a point that should have $\frac{1}{3}$ of its normal voltage, but has zero. A lot of solid-state sets will try to work at an amazingly low line voltage.

R-E

SERVICE QUESTIONS

LOW BRIGHTNESS

I have a low-brightness problem with the picture tube on this Zenith 14A9C50. Tried a brightener but it did not help. The boost is quite low, as is the boosted-boost. Replaced the boost rectifier but that didn't help either. The B++ reads only about +400 volts instead of the +870 volts that it should. I need a new idea.—J.M., Pettus, WV

I think you are already in the right place. Find out why the B++ is so low. That feeds the picture tube's screen controls, and if they are low, they hold the brightness down. With a new rectifier you may have some shunt leakage to ground—not a dead short, but enough to overload the B++ circuit.

(Feedback: "The 'raw boost' was up to about +850 volts as it should be, but the boosted-boost was down. Finally found a very leaky .01 μ F bypass capacitor that was between B+ and the boosted-boost. Had to replace one worn screen control, and the set now works fine.")

Comment: The leaky capacitor was "shorting" the boosted-boost to B+, which is only +400 volts.

INTERMITTENT TRANSISTOR

I had a dead Sony TV-132. The problem was in the low-voltage supply. Transistor Q601 appeared to be open, but when I took it out of the circuit it checked out as good. That threw me for a while. That transistor is in a TO-220 case; on a hunch I bent the leads to make them easier to get to and rechecked the device. The emitter now checked out as open! The lead was broken inside the case. When the leads were returned to their original position, the way they are when the transistor is mounted on the PC-board, it again checked out as good.

Thanks to Yusuf Bandukwala of Houston, TX for that feedback, I've run into similar problems with TO-220 transistors. If you suspect one of them, it's a good idea to take it out and wiggle the leads a little for luck.

We wrote the book on reliability...

... the RCA SK Series Replacement Guide, featuring RCA's line of reliable solid state replacements, the line of integrity with unsurpassed engineering excellence. The accuracy of the Guide's cross-reference directory enables you to replace with complete confidence. So, reach for reliability with RCA SK Series replacements. We wrote the book on it. Pick up a copy at your local RCA SK Distributor.

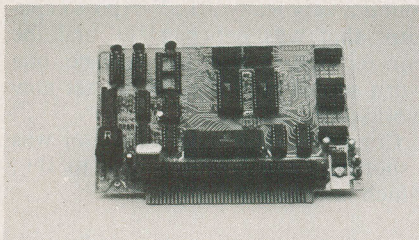
Replace over 170,000 industry types with 1400 RCA types.

RCA SK Replacement Solid State

RCA Distributor and Special Products Division, Deptford, NJ 08096.



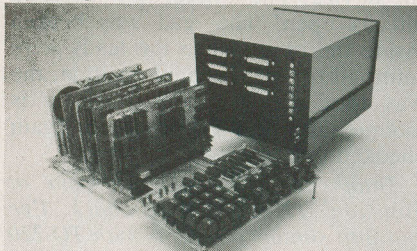
NEW... ONLY \$59.95



THE Anything Board™

**Dedicate it, then separate it!
Does anything you want it to!**

Now, anything you can dream up, Netronics can help you realize—inexpensively and easily with the Anything Board (it's the first and only microprocessor you can dedicate, then separate from the Programming Board so it runs by itself). All this—for only \$59.95 so it's inexpensive, and easy to work with, too, because Netronics helps you every step of the way, with the programming, with the hardware.



Programmer Board shown with cabinet and expansion boards.

You can program the Anything Board by 1. plugging into an ELF II microcomputer or 2. plugging into our programmer board with its special and sophisticated debugging and testing components. The growth is limitless. You can add inputs and outputs, A to D/D to A boards, color graphics, PROTO boards, Electric Mouth Talking Boards, expand the memory. Got something in mind? It can be anything... a robot, burglar alarm, telephone dialer, industrial machine controller... home heating/cooling system... ANYTHING! With your imagination and skills, backed up by Netronics' know-how and help, you can make the Anything Board do anything you want it to do. There are expansion boards—even cabinets to house your Anything project. Give it a professional finished look! The Anything Board... only from Netronics. Only \$59.95.

As your needs for programming grow, you can add system monitors, cassette I/O, an assembler-text editor-disassembler, video terminals, EPROM burner, full basic and more. All plug into the Anything Board expansion Bus.

Specifications: Anything Board

1802 microprocessor, 1K RAM, 8 Bit input port, 8 BIT output port, interrupt, DMA and processor flag inputs, address decoders, provisions for a 2716 EPROM, power on and manual reset, crystal clock, power supply regulator and provision for battery back up.

Specifications: Programmer Board

HEX key pad input, 16 bit address and 8 bit data display outputs, led status indicators, memory protect, wait, load, reset and in put switches plus a single step mode which allows you to step through your program one machine cycle at a time.

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut or For Technical Assistance, Etc.,

Call (203) 354-9375

NETRONICS R&D LTD. Dept. RE 12

333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

- ☐ ANYTHING BOARD \$59.95
☐ Programming Board \$79.95

Plus \$2.00 each item for postage, handling and insurance (\$4.00 Canada)

Connecticut Residents add sales tax

Total Enclosed \$ _____

- ☐ Personal Check ☐ Cashier's Check/Money Order
☐ Visa ☐ Master Charge (Bank No. _____)

Acct. No. _____

Signature _____ Exp. Date _____

Print _____

Name _____

Address _____

City _____

State _____ Zip _____

NEW PRODUCTS

For more details use the free information card inside the back cover.

DYNAMIC MICROPHONE, model F-V3T, is a durable cardioid directional microphone featuring an exclusive Unimatch plug. The microphone is fitted with a die-cast mini-plug that is threaded to accept a supplied 1/4-inch phone-plug adaptor. That eliminates compatibility problems, assuring complete versatility.



CIRCLE 111 ON FREE INFORMATION CARD

The frequency response of the model F-V3T is 100-12,000 Hz, with an output level of 58.8 dBm, making it suitable for many home and office recording situations. Measuring approximately 7 inches in length and weighing 6.4 ounces, it is extremely portable and constructed to assure years of efficient operation. The model F-V3T is priced at \$29.95. — **Sony Corporation of America**, 9 West 57th Street, New York, NY 10019.

SPEAKER SYSTEMS, model 303 Series II and model 304 Series II, combine attractive styling with the latest developments in loudspeaker engineering. Both models are finished in grille cloth on all four sides of the cabinet, and are available in either black or brown with matching metal stands. An exclusive feature of the two



CIRCLE 112 ON FREE INFORMATION CARD

systems, however, is the capability of changing the grille cloth quickly and easily to beige, blue, red, green, or gray; the color grille cloths are available as optional accessories.

The model 303 Series II is a 2-way system using an 8-inch bass unit and a newly-developed 1-inch tweeter. It is capable of achieving output levels higher than 100-dB sound-pressure level. The price of the model 303 Series II is \$225.00 each.

The model 304 Series II is a medium-size loudspeaker system combining the newly-developed 1-inch tweeter with two 8-inch bass units to give extended bass performance. The two identical bass units are arranged to work together over the lower part of the frequency range, and a unique crossover network insures the absence of irregularities at the crossover frequency. The maximum output is 107 dB sound-pressure level. The price of the model 304 Series II is \$350.00 each. — **KEF Electronics, Ltd.**, P.O. Box 17414, Washington, DC 20041.

SCREW-HOLDING DRIVERS, Set No. 89906, is a 4-piece screw-holding driver set containing four frequently-used screw-holding drivers in a colorful box. Included

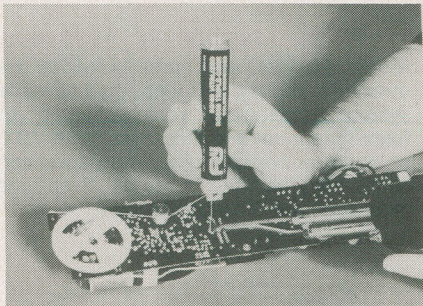


CIRCLE 113 ON FREE INFORMATION CARD

are Vaco Nos. K23, K34, and K46, standard-slotted, and the new K12 Phillips driver. The blade sizes are 1/8 x 3 inches, 3/16 x 4 inches, 1/4 x 6 inches (slotted), and No. 2 Phillips, respectively. Set No. 89906 is priced at \$18.00. — **Vaco Products Company**, 1510 Skokie Blvd., Northbrook, IL 60062.

SOLDER REPAIR KITS for making fast, easy repairs on a variety of electrical and electronics connections in the home or workshop feature triple-core solder dispensers that insure continuous flow while

soldering fine wires and other connections. They are available in both 60% tin/40% lead and 40%/60% combination rosin dispensers; a pre-mixed solder-cream dispenser tube is also included.

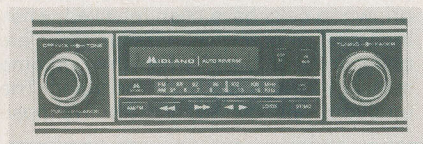


CIRCLE 114 ON FREE INFORMATION CARD

Used with a soldering iron or gun, the kits come with application information and are ideal for electrical wiring, antennas, speaker leads, appliances, TV's, and radios.

The *solder repair kits* range in price from \$1.30 to \$4.50. — **Fry Metals, Inc.**, 50 Sims Avenue, Providence, RI 02909.

CAR CASSETTE PLAYER, model 67-458, is a fully-automatic-reverse stereo cassette player with a highly sensitive, selec-



CIRCLE 115 ON FREE INFORMATION CARD

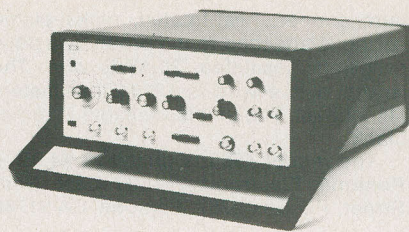
tive AM/FM/FM-stereo receiver. The player features a low-distortion amplifier. The model 67-458 has FM muting, local/distance, and stereo/mono for maximum receiver performance. There is also an easy-to-read illuminated analog AM/FM frequency scale; a tone control that adjusts bass/treble response; balance and fader controls that adjust stereo separation for up to four speakers, and distinctive styling with the side-loading cassette player hidden behind a dust cover.

The model 67-458 is priced at \$149.95. — **Midland International Corp.**, PO Box 1903, Kansas City, MO 64141.

PULSE/FUNCTION GENERATORS, model 514 and model 514A, are combination bench-top instruments; each model has separate pulse and function generation sections.

In the model 514 (shown) the function-generator section operates from 0.001 Hz to 5 MHz and offers sine, square, triangle, trigger and gate operation with output waveforms of 20-volts P-P at the high output. A low output delivers 2-volts P-P. A 40-dB variable control attenuates both the high and low outputs simultaneously. Additional features are variable DC offset. VCF (Voltage Controlled Frequency) input, and sync input. The frequency/period dial operates in a 10-turn resolution mode, or in a dial mode that gives 3-decade single-turn operation.

The pulse-generator section offers single pulse, double pulse, and delayed

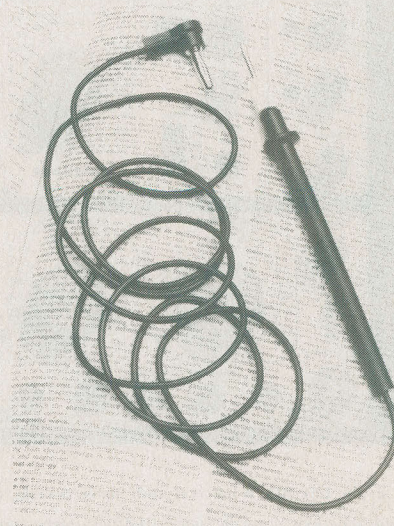


CIRCLE 116 ON FREE INFORMATION CARD

pulse over a frequency range of 0.001 Hz to 20 MHz. The frequency/period dial sets the repetition rate and/or period. The period is adjustable from 1000 seconds to 50 nanoseconds. Pulse width and delay are set by individual calibrated controls. The pulse width and delay are both adjustable from 100 milliseconds to 10 nanoseconds. A squarewave mode is also provided, and the pulse generator can be triggered and gated. Pulses can have their baseline at zero volts or have up to ± 10 volts of DC offset. The model 514 is priced at \$645.00.

The model 514A adds simultaneous outputs from five individual connectors to give TTL, TTL, ECL, ECL, and pulse outputs from the main output amplifier. Eighty dB of attenuation is added in 10-dB steps plus 20-dB of variable gain, and replaces the low-output connector. Pulse rise and fall times are 2 nanoseconds at the ECL outputs, 7 nanoseconds at the TTL outputs, and less than 40 nanoseconds at the main output. There is also variable symmetry and a variable start-stop point on triggered and gated waveforms. The model 514A is priced at \$725.00. — **Exact Electronics**, PO Box 347, Tillamook, OR 97141.

PROBE, model 4800, is a miniature test probe with a right-angle banana plug, and is equipped with a replaceable needle and a finger guard that prevents the



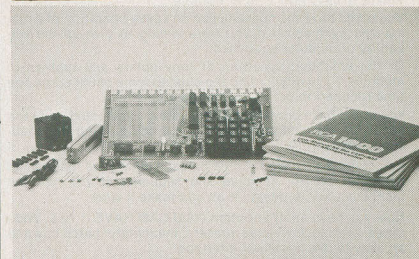
CIRCLE 117 ON FREE INFORMATION CARD

technician's fingers from slipping into the circuitry. The glass-filled nylon probe has a maximum operating temperature of $+102^{\circ}\text{C}$ ($+216^{\circ}\text{F}$).

The banana plug, with one-piece beryl-

WE TAKE YOU BY THE HAND!

You'll learn all about computers: how to build, program, service, even play TV games—without knowing the first thing about it!



The New ELF II "Beginners" Package

Your own expandable micro-computer kit, 5 diagnostic analyzers plus circuit, programming, diagnostic manuals, even games you can play on TV. All only \$139.95.

Even if you don't know bits from bytes, now it's easy and inexpensive to build your own micro-computer, learn how it works, program it, service it—even play games with it on your TV! It's here in the New ELF II "Beginners" Package, only from Netronics. Only \$139.95. Here's the package: 1. your own micro-computer, the famous ELF II (featuring the RCA 1802 CMOS microprocessor) in kit form with step-by-step instructions on how to build it. Diagnostic Analyzers including 2. your own Logic Probe, 3. Pulse Catcher, 4. 8 bit Test Register, 5. Logic Analyzer, 6. Gate Arrays, 7. Non-Technical Manuals on how to use analyzers, how to get into the guts of the computer, what makes it tick, how to service it. 8. Sample Programs that teach you machine language programming plus how to correct or "debug" any programming mistakes. 9. TV games you can play. If your TV set has no video input, an optional converter (RF Modulator), is available. Then, once you've got this "Beginners" Package under your belt, keep on expanding your ELF II with additions like the Typewriter Key Board, added RAM, Full Basic Interpreter, Electric Mouth Talking Board, Color/Music, A/D-D/A Boards for Robot Controls and much, much more. We'll take you by the hand with the New ELF II "Beginners" Package. Only \$139.95. Mail or phone in your order today and begin.

Specifications: ELF II "Beginners" Package
The computer features an RCA CMOS 1802 8 bit microprocessor addressable to 64K bytes with DMA, interrupt, 18 Registers, ALU, 256 byte RAM expandable to 64K bytes, Professional Hex keyboard, fully decoded so there's no need to waste memory with keyboard scanning circuits, built-in power regulator, 5 slot plug-in expansion BUS (less connectors), stable crystal clock for timing purposes and a double-sided, plated through PC Board plus RCA 1861 video IC to display any segment of memory on a video monitor or TV screen along with the logic and support circuitry you need to learn every one of the RCA 1802's capabilities. The diagnostic analyzers aid in understanding and trouble shooting your ELF II, as well as other computer and microprocessor products.

Continental U.S.A. Credit Card Buyers Outside Connecticut
CALL TOLL FREE 800-243-7428
To Order From Connecticut or For Technical Assistance, Etc.,
Call (203) 354-9375

NETRONICS R&D LTD. Dept. RE 12
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

☐ ELF II "Beginners" Kit \$139.95
☐ RF Modulator \$ 8.95

Plus \$3.00 for postage, handling and insurance
(\$6.00 Canada)

Connecticut Residents add sales tax

Total Enclosed \$

☐ Personal Check ☐ Cashier's Check/Money Order
☐ Visa ☐ Master Charge (Bank No. _____)

Acct. No. _____

Signature _____ Exp. Date _____

Print Name _____

Address _____

City _____

State _____ Zip _____

PROTEUS I™ a lead synthesizer that has it all!



You've always had a lot of options.

You could have the convenience and easy operation of a normalized synthesizer if you were willing to give up the versatility of modular equipment.

Or the unlimited spectrum of tone colors and timbres of modules if you didn't mind the cumbersome patch cords and time required to set up or change a patch.

You could have programmable presets if you could raise the bucks, or low-cost equipment if you could stand the snap-crackle-pop.

You could even have such technically innovative features as computer control of voice and sequence if you had the technical savvy to design it all and make it work.

Now you have another option. YOU CAN HAVE IT ALL. Wide range, precise, low-noise, presets, meaningful patch bay and an easy-to-use computer interface.

All at a price that's nothing but unbelievable.

Want to know more? Proteus I's Using/Assembly manual which includes a demo tape will answer all of your questions. The price, \$10.00 is refundable upon purchase of the kit.

PART OF THE NEW GENERATION FROM

PAIA Electronics, Inc.

1020 W. Wilshire, Oklahoma City, OK 73116 - (405) 843-9626
CHARGE ORDER? Call our 24 hour Demo/Order line
405-843-7396

- ☐ Send the easy-to-assemble Proteus I Kit, \$499.00 enclosed. (Freight Collect)
- ☐ Tell me more, Rush the Assembly/Using manual & demo tape for Proteus I. (\$10.00 enclosed, refundable)
- ☐ Send free catalog

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Visa _____ MC _____ Card No.: _____

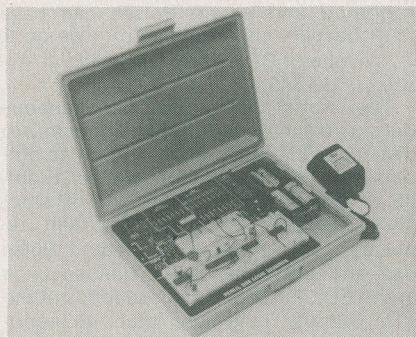
PAIA Electronics, Dept. 12AR 1020 W. Wilshire, Okla. City, OK 73116

CIRCLE 77 ON FREE INFORMATION CARD

lithium copper, heat-treated, nickel-plated spring is attached to the probe by a polypropylene insulated, 20-AWG wire. The length of the wire is 1219.2 millimeters (48 inches). The unit is available in red or black.

The *model 4800* is priced at \$4.85. — **Pomona Electronics**, 1500 East Ninth Street, PO Box 2767, Pomona, CA 91766.

PENCIL BOX LOGIC DESIGNER, *model LD-1*, is a new, portable logic-design and breadboarding instrument, available either in kit or assembled form. The *model LD-1* provides major design needs in a portable molded plastic case with an integral hinged cover. Some of the features are a variable clock, two pulsers, eight LED readouts, eight logic-level switches, and the E & L *model SK-10* solderless breadboarding socket. Power is supplied through batteries or an op-



CIRCLE 118 ON FREE INFORMATION CARD

tional AC supply. The *model LD-1* is priced at \$75.00 for the kit (P/N 325-4301); assembled (P/N 325-1301), it costs \$99.50. — **E&L Instruments Inc.**, 61 First Street, Derby, CT 06418.

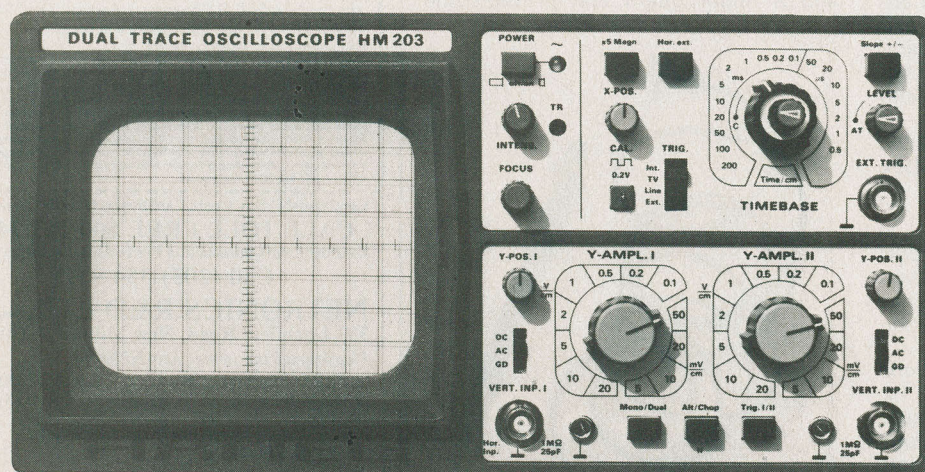
TELEPHONE-ANSWERING SYSTEMS, *model AN-3300* and *model AN-3500* are microprocessor controlled, dual-cassette systems, featuring voice-activated or fixed-time incoming messages. With VOX, or voice-activated mode, messages can be as long as three minutes; fixed-time messages are 30 seconds long.



CIRCLE 119 ON FREE INFORMATION CARD

The *model AN-3300* (shown) has monitor capability through the built-in speaker or earphone (jack provided). There is also a built-in condenser microphone, plus two external mike jacks. LED indicators tell the operator when power is on; when calls have been received; when incoming or outgoing message tapes are being recorded, and when the outgoing message tape is ready for recording. The function selector switch has five posi-

HAMEG PRESENTS THE NEW HM 203



High performance
at
low cost.

\$580

(PROBES INCLUDED)

A quality scope,
made in the U.S.A.,
by a company with
over 23 years
experience.

Hameg introduces high performance at low cost in the HM 203, a full featured, highly reliable, dual trace 20 MHz oscilloscope. For only \$580, the HM 203 has specifications normally associated with higher priced scopes. Bandwidth - DC → 20 MHz • Risettime 17.5 ns • Overshoot 1% max. • Y amp range 5 mv/cm to 20 v/cm • Max. input voltage 500V • Timebase .5 μs/cm to .2s /cm • Sweep mag. x5 • Trigger 5 Hz to 30 MHz • X-Y plot • Built-in probe calibrator and more. Its sturdy construction and light weight (13.2 lbs.) make the HM 203 equally at home in the field and on the test bench.

CIRCLE 64 ON FREE INFORMATION CARD

HAMEG

88-90 Harbor Rd.

Port Washington, N.Y., 11050

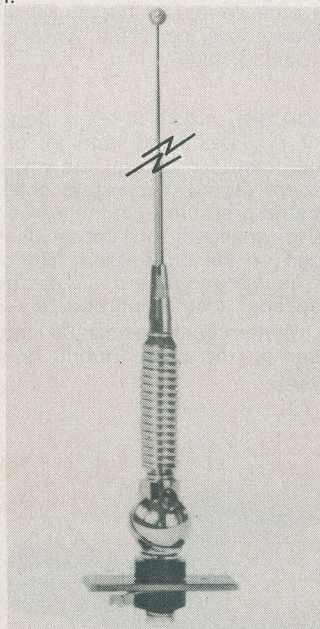
Tel: (516) 883-3837



tions: RECORD and CHECK (outgoing messages); ANSWER and PLAYBACK (incoming messages), and 2-WAY RECORD/DICTATE.

The model AN-3300 is priced at \$189.95. Model AN-3500 is identical with the above except for the added remote key, which permits calling in from anywhere in the world to pick up recorded messages. Functions include rewind (to play back messages); backspace (to replay any portion of a message just listened to), and reset (to set tape back to the beginning for new messages coming in to be recorded). The model AN-3500 is priced at \$239.95. — **Cobra Communications**, 6460 W. Cortland St., Chicago, IL 60635.

MOBILE ANTENNA, model ASP-775, for small cars, is a 39-50 MHz, quarter-wave whip that needs only a 1-inch wide and 2½-inch long flat mounting area. It will handle 150-watts maximum RF power, and has a VSWR of less than 1.5:1 across the specified 3.5-MHz bandwidth.



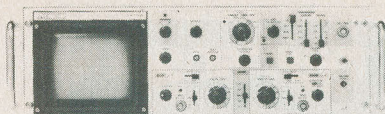
CIRCLE 120 ON FREE INFORMATION CARD

The model ASP-775 featured a tapered, stainless-steel whip, compactly designed shock spring, and swivel base. A back-up plate is provided to reinforce the mounting area: cable, connector, and Allen wrenches are also included. The user should specify operating frequency to the nearest 1/10 MHz when ordering. The model ASP-775 is priced at \$45.00. — **The Antenna Specialists Co.**, 12435 Euclid Avenue, Cleveland, OH 44106.

OSCILLOSCOPE, model 1479R, is a dual-trace 30-MHz oscilloscope enclosed in a rugged, rack-mount case for manufacturing, educational, military, and wireline-logging applications.

Switch-selectable front- and rear-channel inputs allow use as a general-purpose oscilloscope, and as a dedicated device with permanent connection to other rack-mounted equipment.

The 2 mV/cm vertical sensitivity allows observations and measurements of low-level signals. A signal-delay circuit permits viewing of fast rise-time pulses, with



CIRCLE 121 ON FREE INFORMATION CARD

a maximum sweep time of 0.1 ms/cm. In addition, the model 1479R provides single-sweep operation for easier observation and photographing of irregular waveforms. Video coupling allows synchronization to video frame and line.

Other features include variable hold-off, alternate trigger, trigger fix, sweep and gate outputs, etc., which normally are found only in more expensive oscilloscopes. The model 1479R is priced at

\$1495.00. — **B&K Precision Product Group**, Dynascan Corporation, 6460 W. Cortland Ave., Chicago, IL 60635.

PORTABLE LIGHT, Bend-A-Light, features a high-intensity light beam coupled with a flexible shaft that reaches and illuminates areas where conventional hand-held lighting fails. It combines a miniature, prefocused optical lens and lamp, rated at 2.5 volts, that focuses and concentrates a brilliant light into a pinpoint beam.

Bend-A-Light uses a ⅛-inch ultra-slim, special-alloy shaft 10 inches long; that shaft allows repeated bending in any configuration. It can reach around corners and into areas as small as ¼-inch wide. It

Electronics Paperback Books

Quality Paperbacks at Affordable Prices

CHECK OFF THE BOOKS YOU WANT

28 Tested Transistor Projects

☐ 28 TESTED TRANSISTOR PROJECTS \$3.50. They're easy to build and fun to use. You'll want to try every one.

Digital IC Projects

☐ DIGITAL IC PROJECTS \$4.95. Simple and advanced projects based on digital IC's. We count 28 different circuits.

Model Railway Projects

☐ MODEL RAILWAY PROJECTS \$4.95. Controllers, signals and sound effects that bring your railroad to life.

Single IC Projects

☐ SINGLE IC PROJECTS \$3.75. Just look at what you can build with an ordinary IC.

IC LM3900 Projects

☐ IC LM3900 PROJECTS \$3.50. A very versatile op-amp with audio, linear, digital and signal generator applications you'll want to try.

50 CMOS IC Projects

☐ 50 CMOS PROJECTS \$3.50. Multivibrators, amplifiers and oscillators. Trigger devices and special devices are described.

50 Simple L.E.D. Circuits

☐ 50 SIMPLE LED CIRCUITS \$3.50. It would be difficult to come up with a circuit not described in this book.

50 Circuits Using 7400 Series IC's

☐ 50 CIRCUITS USING 7400 IC's \$3.50. Ingenuity is the only limitation to the uses this family of low-cost IC's can be put to.

Practical Computer Experiments

☐ PRACTICAL COMPUTER EXPERIMENTS \$4.75. Build working computer circuits using discrete logic IC's.

Counter Driver and Numerical Display Projects

☐ COUNTER DRIVER & NUMERICAL DISPLAY PROJECTS \$4.50. Practical counter and display projects that can be used in almost any device you care to design and build.

50 Circuits Using Germanium Silicon & Zener Diodes

☐ 50 CIRCUITS USING DIODES \$3.50. Circuits using germanium, silicon, germanium and Zener diodes you'll want to try.

Power Supply Projects

☐ POWER SUPPLY PROJECTS \$4.95. Complete instructions for building all kinds of power supplies for a variety of applications.

1st Book of Hi-Fi Loudspeaker Enclosures

☐ FIRST BOOK OF SPEAKER ENCLOSURES \$3.25. Complete data on building many varieties of Hi-Fi speaker enclosures.

ELECTRONIC TECHNOLOGY TODAY INC.
P.O. Box 83, Massapequa Park, NY 11762

12-81

Number of books ordered

Total Price of Books.....

Sales Tax (NY State Residents only)

Shipping and Handling (60¢ 1 or 2 books. 25¢ each addl.)

TOTAL ENCLOSED

Name.....

Address.....

City..... State..... Zip.....

PRICES GOOD UNTIL JAN. 30, 1982

The TSE-HARDSIDE 1982 Micro-Computer Buyer's Guide

is now available! We've included such valuable information as print samples from each of the printers we carry, feature-by-feature comparisons of micro-computer systems in an easy-to-read table format, an informative article on Micros, and pages and pages of complete product descriptions. We're making this valuable reference available for only \$2.95 (credited toward first purchase from TSE-HARDSIDE). Just clip the coupon (or send a note) with your check for \$2.95 to the address below. THE TSE-HARDSIDE 1982 BUYER'S GUIDE will soon arrive postpaid to your door.

Yes! Send me the
**TSE-HARDSIDE
1982 Micro-Computer
Buyer's Guide.**

☐ I've enclosed \$2.95 ☐ Please send only your FREE Price List

Name _____

Address _____

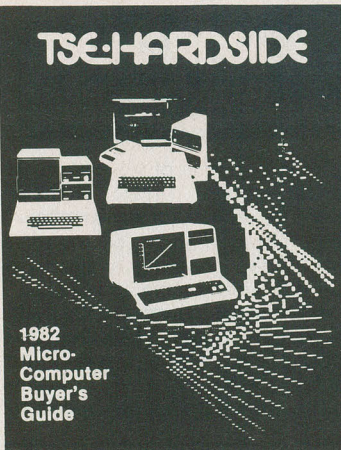
City _____

State _____

Zip Code _____

Send to:

TSE-HARDSIDE
Dept. C, 14 South Street
Milford, NH 03055



RE

CIRCLE 67 ON FREE INFORMATION CARD

*"Our little vise is on
everyone's list this Chris mas.
Look for our display
at your local dealer."*

**Model 350 The PANAVISE
Multi Purpose Work Center**

Look for your Christmas gift in each Model 350 box.

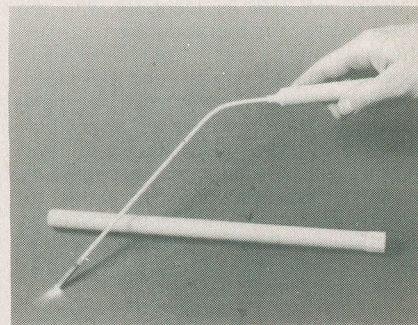
PANAVISE®

PANAVISE PRODUCTS, INC.
2850 E. 29th ST., LONG BEACH, CA 90806
(213) 595-7621



CIRCLE 72 ON FREE INFORMATION CARD

extends to 27 inches, with an unbreakable PVC dual-purpose extension tube that also serves as a casing to protect the shaft. Also featured is a stainless-steel



CIRCLE 122 ON FREE INFORMATION CARD

tip that will not rust. Conventional AA cells are used. Optional features include a heavy-duty shaft pick-up magnet and a handle clip-on magnet for versatility.

Bend-A-Light is priced at \$24.50; with all the accessories, the cost is \$36.95. — **L&W Enterprises, Inc.**, 200 S. Washington, Royal Oak, MI 48067.

BAROGRAPH, model ID-2090, designed as a kit, provides digital readings of current barometric pressure and makes a permanent record of pressure changes. Barometric pressure — in inches of mercury (Hg), millibars, or kilopascals — is recorded on the drum chart. The chart can be adjusted to record at 7-day or 31-day speeds (with appropriate chart paper.) Written notations can be made by the user on the chart, during or after recording.



CIRCLE 123 ON FREE INFORMATION CARD

A four-digit LED display shows the current pressure (28-32 inches of mercury, 948-1083 millibars, or 94.8-108.3 kilopascals) at the same time it's recorded on the chart. An LED indicates the unit of measurement currently in use (Hg, MB, or KPA). Cabinet switches allow the user to recall maximum and minimum barometric readings (since last cleared) with the time and date they occurred from the model LD-2090's memory. A separate 6-digit display alternately shows the current time (in 12- or 24-hour formats) and a 4-year calendar, or continuously displays time or date.

The easy-to-build kit features a transparent, smoked plastic dust cover for the chart-recorder drum. A one-year supply of chart paper is provided; additional chart paper and a replacement pen are available separately. The model ID-2090 is priced at \$295.95, mail order. — **Heath Company**, Benton Harbor, MI 49022.

continued on page 104

What's News

National Semiconductor, Motorola sign bubble agreement

National Semiconductor Corp. and Motorola Inc. have signed an alternate-source agreement which will allow them to develop, manufacture, and market 256-kilobit and 1-megabit magnetic bubble memory devices, and LSI (Large-Scale Integration) bubble-memory controllers.

To insure that there is a true alternate source, National Semiconductor will provide Motorola with a full design data base, including basic device architecture and test procedures.

National's three-year-old bubble program produces the smallest bubble-memory devices available. That economy in size, plus the devices' standard 16-lead pin-out, promises to make them industry standards, National believes.

New watch "tells time"

A watch has at last been developed that justifies the old expression "tells the time."

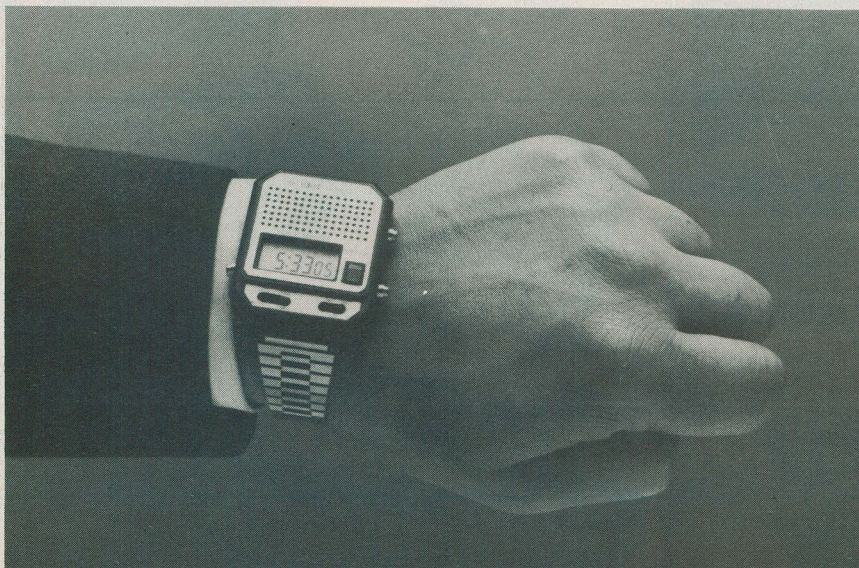
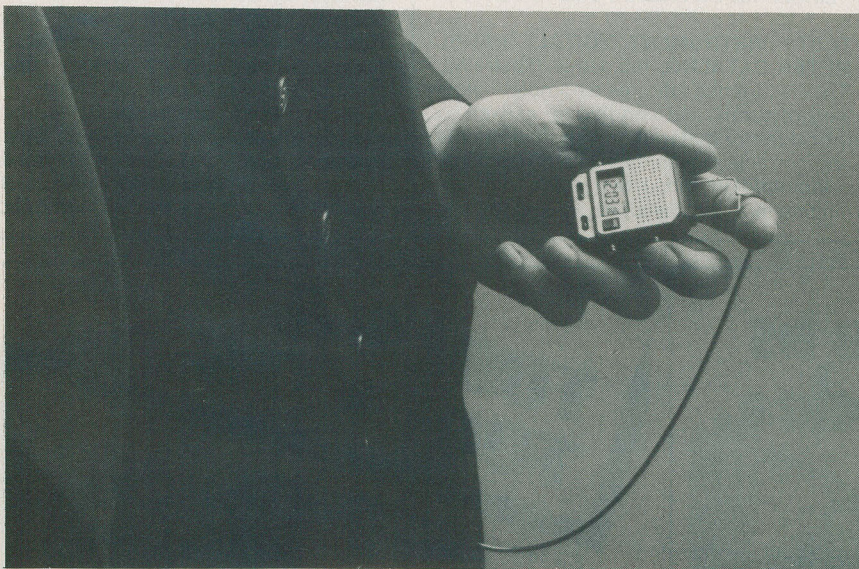
Press the "speak" button and the watch gives the hours and minutes, AM or PM, using a synthesized human voice.

The *Omni Voice Master* is built in a square case, and can be worn on the wrist, used as a pocket watch or, when mounted in a stand supplied with it, used as a miniature desk clock or attached to the dashboard of an automobile.

The alarm wakes the sleeper with gentle music, gives the time, then follows with another 20 seconds of music. If not turned off, five minutes later it says: "Attention!" gives the time, and tells the sleeper to "please hurry!" That is repeated later.

In the "chime" mode, the watch "tells the time" every hour and half hour. It is also a stopwatch. When used to time an event, it tells the elapsed time every five seconds, and, when stopped, gives the total elapsed time in minutes and seconds.

The *Voice Master* uses four standard UC393 cells that will operate the watch for eight or nine months of normal use. **R-E**



THE OMNI VOICE MASTER can be used four ways: as a pocket watch (above); worn on the wrist (below); on an automobile dashboard, or as a desk clock.

FREE...

Catalog of great gift ideas



You'll find the right gift for all the electronics buffs on your Christmas list - from clocks and radios to gas-saving car accessories to computers - all in easy-to-build,



money-saving kits. Prices start at under \$20.

This year, shop the fast, easy way in the Heathkit Catalog.

Heathkit®

If coupon is missing, write
Heath Co., Dept. 020-842
Benton Harbor, MI 49022.

Send to: Heath Co., Dept. 020-842
Benton Harbor, MI 49022.

Send my free Heathkit Catalog now.
I am not currently receiving your catalog.

Name _____

Address _____

City _____ State _____

CL-745 Zip _____

CIRCLE 66 ON FREE INFORMATION CARD

NEW LIT.

For more details use free information card inside back cover.

TRAINING-TAPE CATALOG is a complete reference guide to Sony's video training-tape library. The catalog is divided into three categories: basic fundamentals, technical training on specific products, and special programs.

The section on basic fundamentals describes the courses on a wide variety of video-related subjects in easy-to-understand language. The technical-training category explains the Sony tapes dealing with specific video products. Usually consisting of eight tapes in a series, they begin with tapes on "operation" and "technical overview" for the non-technician, and then cover hard technical information for those requiring more detailed knowledge. The special-programs tapes, best used by dealers and salespeople, are released as new equipment is introduced. The catalog describes those tapes available now, including product-demonstration tapes on the Sony Video Responder and model DXC-1800 color camera and visual demonstration

method. Free upon request.—**Sony Video Communications**, Tape-Production Department, 700 West Artesia Boulevard, Compton, CA 90220.

CIRCLE 151 ON FREE INFORMATION CARD

CROSS-REFERENCE LIST, two-color, 8 pages, 8½ × 11 inches, is a comprehensive cross-reference list of TRW part numbers. There are more than 1900 entries, showing EIA numbers in conventional order and the corresponding TRW number. Free upon request.—**TRW Power Semiconductors**, 14520 Aviation Blvd., Lawndale CA 90260.

CIRCLE 152 ON FREE INFORMATION CARD

TEST INSTRUMENT/DIGITAL PANEL METER CATALOG, 190 pages, illustrated, 8½ × 11 inches features a complete glossary of terms and conditions, as well as introductory material on test instruments and portable digital multimeters in general.

Included in those two categories are multimeters, oscilloscopes, AC and DC volt-

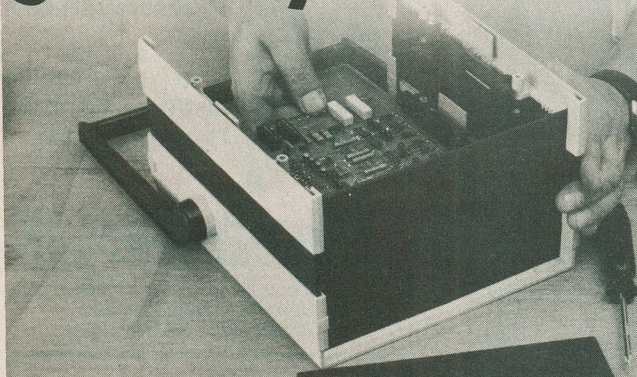
imeters, temperature meters, frequency monitors, frequency meters, counters, and logic probes. The individual instruments are shown in clear photos, and with each there is a list of specifications, applications, and descriptions. Free upon request.—**Non-Linear Systems, Inc.**, Box N, Del Mar, CA 92014.

CIRCLE 153 ON FREE INFORMATION CARD

ELECTRONICS CATALOG, 32 pages, tabloid size, is fully illustrated and lists all manner of electronics equipment and components, such as color converters, transistors, filter capacitors, liquid crystal displays, light sources, channel-selecting keypads, digital printers, humidity controllers, blowers, air compressors, motors, timers, transformers, power supplies, noise suppressors, heat sinks, switches, pots, relays, digit counters, bridges, microphones—and many others. Free upon request.—**Technical Electronics**, PO Box 2361, Woburn, MA 01888. R-E

CIRCLE 154 ON FREE INFORMATION CARD

An enclosure as good as your idea.



You've turned a good idea into a piece of equipment—now you need a good enclosure. Here's how PacTec can help you with our versatile enclosures:

- Attractive yet inexpensive.
- Durable ABS construction.
- Many sizes, colors, accessories.
- Built in bosses and slots speed component mounting.
- Available off-the-shelf from single unit to production quantities. See them at your **PacTec Distributor**. And ask him for your free catalog.

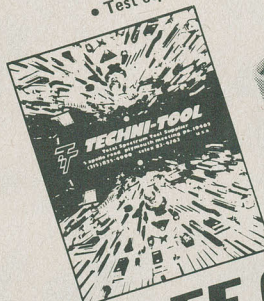
PACITEC™ Corp.
subsidiary of La France Corp.
Enterprise and Executive Avenues
Philadelphia, PA 19153 (215) 365-8400



CIRCLE 74 ON FREE INFORMATION CARD

TOOLS & TOOL KITS

- Custom and standard tool kits
- Complete assortment of English and Metric tools
- Soldering equipment — all voltages
- Vises and positioners
- Test equipment



FREE CATALOG
TECHNI-TOOL

5 Apollo Road, Plymouth Meeting
Pa. 19462
(215) 825-4990

Telex 83-4763
U.S.A.

CIRCLE 76 ON FREE INFORMATION CARD

NEW BOOKS

For more details use free information card inside back cover.

ELEMENTS OF SOLID STATE PHYSICS, by M. N. Rudden & J. Wilson. John Wiley & Sons, Inc., One Wiley Drive, Somerset, NJ 08873. 186pp.; 6 1/2 x 9 1/4 inches; hardcover. \$40.00.

Unlike many other introductory texts on solid-state physics, this one assumes no prior knowledge of quantum or statistical mechanics on the part of the student, but relies on simple models to illustrate the physical principles. As a basic introduction to those principles, it is designed for first-year students in physics, materials science, and electrical/engineering courses.

The student is provided with a wide range of numerical problems with solutions and hints, together with a large number of descriptive questions that can serve as a means of self-testing.

Following the preface and prologue, the six chapters are titled "Some Aspects of Modern Physics," "Classical Theories of Conduction and Magnetism," "Energy Bands in Solids," "Quantum Theory of Conduction," "Structure of Crystalline Solids," and "Semiconductor Devices." The book is illustrated with charts, diagrams, and line drawings. There are also discussion questions, answers to the problems posed at the end of each chapter, a suggested reading list, appendices, and an index.

CIRCLE 141 ON FREE INFORMATION CARD

SON OF CHEAP VIDEO, by Don Lancaster. Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268. 223pp, including appendices; 5 1/2 x 8 1/2 inches; softcover. \$8.95.

This, like its predecessor, *The Cheap Video Cookbook*, is a build-it-yourself hardware book for hardware fans. It will show you very low-cost ways of getting alphanumeric and graphic video out of a microcomputer and onto an ordinary TV set.

For example: you can build a complete video-display system (called "scungy video") for \$7.00. It eliminates one or both of the custom PROM's used in "cheap video," and it needs far less address space. It's also easier to interface to different microcomputers, is much simpler, and is more versatile. You'll get all the details on how to do it in the first chapter.

The second chapter shows you how to run a video display and compute at the same time without interaction. The sneaky device that permits this operation is called "the snuffer," and it can be built for under one dollar.

Further ingenious ways of getting good electronic results without more than a modicum of the conventional cost in-

clude custom characters; a music display; cheap video—Heath H8 hardware; 8080 cheap video—Heath H8 software, and lower-case hardware and software for the Apple II (one chapter on each of those). The appendices at the back of the book show pinouts of selected IC's, printed-circuit patterns, and more character-generator details.

CIRCLE 142 ON FREE INFORMATION CARD

HANDBOOK OF ELECTRONIC METERS: Theory and Application, by John D. Lenk. Prentice-Hall, Inc., Englewood Cliffs, NJ 07632. 228pp., including index; 6 1/2 x 9 1/4 inches; hardcover. \$18.95.

This revised and enlarged edition is designed to be both a basic textbook for student technicians, hobbyists, and experimenters, and a factual guidebook for experienced, working technicians. Much of the material from the first edition has been revised for clarification or simplification. Existing information has been updated to reflect present-day trends, particularly the extensive use of digital meters.

As in the original edition, this handbook can be used to supplement the operating instructions that accompany any meter (digital or analog), whether it be a low-priced shop type or a precision laboratory instrument. That is done by providing a variety of test, measurement, service, and troubleshooting procedures using the meter as the basic tool. The procedures are presented in "cookbook" fashion. Each procedure is preceded by a brief description of the "why" and the "where" for the particular test. Each operation is illustrated with test connection diagrams.

Chapter 1 discusses the basics; chapters 2 and 3 cover accessory probes and fundamental operating procedures. Test and calibration of meters are then dealt with (chapter 4). Special measurement procedures are covered in chapter 5, then chapter 6 deals with the use of meters to check individual components, and chapter 7 is concerned with circuit functions. The final chapter (8) concentrates on servicing specific circuits with meters.

CIRCLE 143 ON FREE INFORMATION CARD

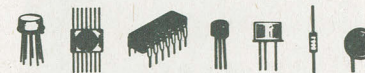
Take stock in America.

Vital protection for PC Boards



Be safe. Desolder PC components with Endeco irons. Get proper HEAT TO MELT and strong VACUUM ACTION TO LIFT solder and cool both PC board and component without damage.

These PC components replaced fast with Endeco desoldering or soldering tools.



Endeco professional features include safety light that denotes high, low and off on switch models, SS construction for long life, light weight and balance for easy use.

Contact your distributor for Endeco desoldering and soldering irons, kits and equipment—or write us today.

Enterprise Development Corp.

5127 East 65th Street
Indianapolis, IN 46220
Phone: (317) 251-1231

CIRCLE 81 ON FREE INFORMATION CARD

ILP AUDIO MODULES



HY50 Amplifier
30 WATTS RMS \$28.95

High performance amp with rugged aluminum heatsinks. Measure only 4" x 2" x 1" thick! Mounts with 2 screws. Gives 30 watts RMS at 0.02% distortion. Response 10 — 45 KHz. 4 to 16 ohms. ±25 V/2A.

HY30. 15 watts RMS. Size/specs as HY50. 20 V/2A. 25.95

HY200 Amplifier
120 WATTS RMS \$79.95

High performance amplifier with large heatsink area for cool operation. Fully protected circuitry. Distortion only 0.01% at 120 watts RMS (1 KHz). Response 10 Hz — 45 KHz. S/N ratio 100 db. Only five connections. Amazingly compact — only 4 1/2" x 4" x 2" D. Mounts with 2 screws. Requires ±45 V/3A. 4 to 16 ohms. HY120. 60 W RMS. Specs/size as HY200. ±35 V/2A 59.95
HY400. 240 Watts RMS (4 ohm). Double the power, double heatsink area! Same specs as HY120/200. May be used into 8 ohms at reduced output. ±45 V/4A \$99.95

HY6 Mono Preamp \$25.95

HY66 Stereo Preamp 48.95

Inputs for RIAA phono, tape with monitor, tuner, auxiliary and microphone; full tone control circuitry. Incredible performance: Response DC to 100 KHz, distortion 0.05%, S/N 90 db. Output to 4.5 V RMS. Supplied with edge connectors. Compact. Reliable. Internal voltage regulation — use from 15 to 50 V safely!

Name _____
Address _____
City _____ Zip _____
Please send _____ Amt. _____
Check () M/O () Visa () M/C ()
Number _____ Exp. (716) 849-0735
GLADSTONE Electronics
901 Fuhrmann Blvd., Buffalo, N.Y. 14203

CIRCLE 79 ON FREE INFORMATION CARD

DECEMBER 1981

NEW PRODUCTS

continued from page 100

NOISE ANALYZER, model NA-1, enables the operator to hear noise currents; picks up and identifies radiating noise fields; traces signals; tests speakers, and checks circuit continuity.

The unit is designed for autosound installers, marine electronic installers, audio technicians, and commercial sound installers. It troubleshoots the cause of a noisy stereo installation quickly and accurately, thereby saving many hours of service time. The maximum in-

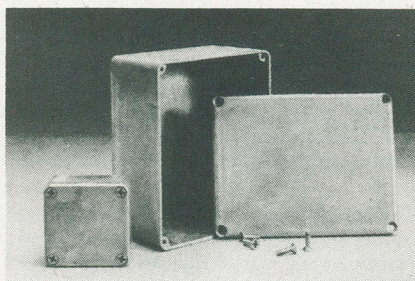


CIRCLE 124 ON FREE INFORMATION CARD

put sensitivity is 20 microvolts; maximum voltage to 32-volts DC; it picks up noise currents to 2 microamps without hum, and has pin-type conductive probes and in addition, there is a directional inductive probe.

The model NA-1 is priced at \$149.95. — **Pacific Accessory Corporation**, 3613 W. MacArthur Blvd. #603, Santa Ana, CA.

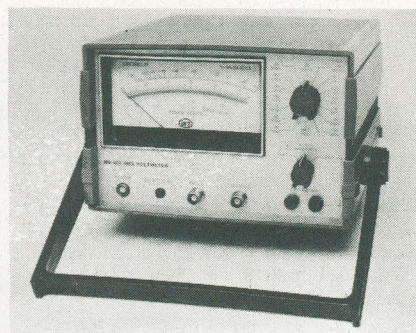
BOXES, made of improved diecast aluminum alloy have good RF shielding that makes the smaller sizes excellent for RF connectors. The countersunk lids have interlocking flanges, and the boxes are



CIRCLE 125 ON FREE INFORMATION CARD

drilled and tapped for screws provided. The boxes have an attractive ground and tumbled finish, which may be painted if required. The boxes are priced between \$3.40 and \$36.00, depending on size — **Hammond Manufacturing Company (US) Inc.**, 1690 Walden Ave., Buffalo, NY 14225.

VOLTMETER, model MV-800, is an RMS analog instrument that accurately presents the effective power of waveforms which depart from a true sine wave. Fifteen ranges are provided, from 30 μ V



CIRCLE 126 ON FREE INFORMATION CARD

full scale to 300 volts, and from -90 dB full scale to +50 dB in decades. Readings as low as -105 dB can be made.

A front-panel bandwidth switch permits a choice of wide-band measurements, standard first-order audio bypass (20 Hz - 20 KHz) or "external filter." A group of standard or custom plug-in filter modules are also available.

Internal, rechargeable Nicad batteries allow the model MV-800 to be isolated completely from the power line and external grounds.

The model MV-800 is priced at \$495.00. — **IET Labs, Inc.**, 761 Old Country Road, Westbury, NY 11590.

continued on page 106

INTERNATIONAL FM-2400CH FREQUENCY METER FOR TESTING MOBILE TRANSMITTERS AND RECEIVERS

Portable • Solid State • Rechargeable Batteries

The FM-2400CH provides an accurate frequency standard for testing and adjustment of mobile transmitters and receivers at predetermined frequencies.

The FM-2400CH with its extended range covers 25 to 1000 MHz.

The frequencies can be those of the radio frequency channels of operation and/or the intermediate frequen-

cies of the receiver between 5 MHz and 40 MHz.

Frequency stability: $\pm .0005\%$ from +50° to +104°F.

Frequency stability with built-in thermometer and temperature corrected charts: $\pm .00025\%$ from +25° to +125° (.000125% special 450 MHz crystals available).

- Tests Predetermined Frequencies 25 to 1000 MHz
- Extended Range Covers 950 MHz Band
- Pin Diode Attenuator for Full Range Coverage as Signal Generator
- Measures FM Deviation.

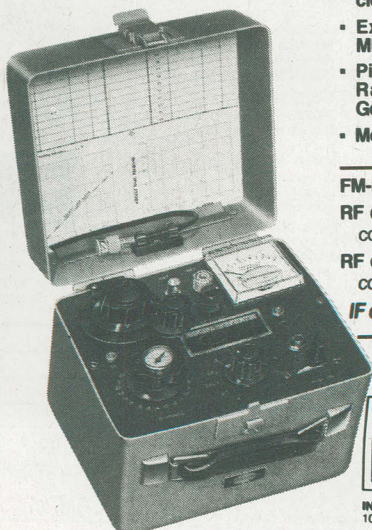
FM-2400CH (meter only) \$690.49

RF crystals (with temperature correction) \$28.89 ea.

RF crystals (less temperature correction) \$21.92 ea.

IF crystals catalog price

Write for catalog



INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee Oklahoma City, Okla. 73102

CIRCLE 75 ON FREE INFORMATION CARD



WE'VE GOT THE SCANNER FREQUENCY INFO YOU WANT!

Join SCAN, and join the ever increasing number of scanner enthusiasts who are getting all the frequency information they need to really use their scanners! You get an F.C.C. quick reference frequency allocations chart; plus SCANNING TODAY magazine, a forum for scanning news and technical articles with regular frequency updates from all across the United States. Also, FREE classified ads allow members to exchange frequency info, 10-codes, as well as sell and exchange equipment with over 30,000 members nationwide.

Your membership kit includes an I.D. card, certificate, vehicle decal, and much more. Join today and get free "Scanners Hear It First" bumper sticker! Send check or money order for \$10.00 to:



Scanner Association of North America
Suite 1212 RE, 111 E. Wacker Drive, Chicago, IL 60601.

CIRCLE 86 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

continued from page 41

digit LED display. The timebase uses a 3.58 MHz crystal. The temperature stability is said to be ± 10 parts-per-million from 0 to 40 degrees centigrade. Setability is said to be ± 1 part-per-million, which seems to agree with our findings. The input impedance is 1 megohm shunted by 24 pF. Maximum input voltage is 150-volts RMS up to 100 kHz. From there, the maximum input voltage decreases in a linear fashion as the frequency increases; the maximum input at 225 MHz is 5-volts RMS. Inputs are coupled to the meter using front-panel-mounted BNC-type connectors. No test leads are supplied with the unit.

Standard IC's, installed in sockets, are used throughout, and the circuit-board layout is such that most parts are easy to get to. All of that greatly simplifies troubleshooting and servicing. As always, there is an ample section covering troubleshooting in the manual, including a large schematic, and a parts list that gives acceptable substitutes where available. Of course, the company provides back-up service if you should run into a problem that you can not correct yourself. Incidentally, our unit operated properly immediately upon completion; that's not a rare occurrence with Heathkit products.

The power requirements for the counter are 108-132-volts AC at 50-60 Hz. In addition, the dual primary of the power supply can be rewired for 206-264-volt operation. That change can be made either during assembly, or at a later date. Power consumption is 25 watts.

In general we found the unit to perform as claimed and could find very few negative points. The power transformer was a bit noisy, but ours could be an isolated case; in any event, it was not bad enough to be distracting. Although the 225-MHz upper limit may seem a trifle low, the counter is an excellent buy, considering the price. In addition, the low upper limit is not really a problem in a majority of applications. The model IM-2410 kit sells for \$124.95; the assembled model SM-2410 sells for \$170.00.

R-E

**Take
stock
in America.**

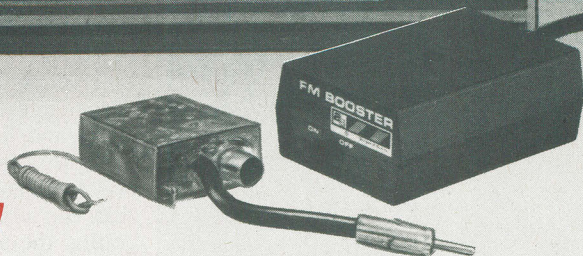


A public service of this publication
and The Advertising Council.

Stereo Expanders. Two great solutions to spotty FM car radio reception.



...and great gift ideas!



You know the problem. Station fading...picket fencing...generally poor and frustrating FM car radio reception in the country and suburbs. We've ended all that with our great little space-age Stereo Expander devices. Hooked up between the radio and the broadcast antenna, they create a tremendous boost in sensitivity—over 15 dB—bringing in far-away FM stations sharp and clear. Simple, effective. Model ASC-100 hides completely out of sight; Model ASC-100DX mounts neatly anywhere underdash, has an off switch when the boost isn't needed.

the antenna specialists co.



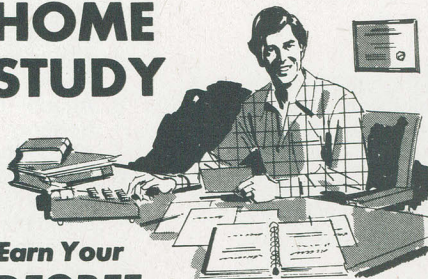
a member of The Allen Group Inc.

© "Stripes of Quality"

12435 Euclid Avenue, Cleveland, OH 44106
International Div.: 2200 Shames Dr.
Westbury, L.I. New York 11590
Canada: A. C. Simmonds & Sons, Ltd.

CIRCLE 85 ON FREE INFORMATION CARD

Put Professional Knowledge and a COLLEGE DEGREE in your Electronics Career through HOME STUDY



Earn Your DEGREE

No commuting to class. Study at your own pace, while continuing your present job. Learn from easy-to-understand lessons, with help from your home-study instructors whenever you need it.

In the Grantham electronics program, you first earn your A.S.E.T. degree, and then your B.S.E.T. These degrees are accredited by the Accrediting Commission of the National Home Study Council.

Our free bulletin gives full details of the home-study program, the degrees awarded, and the requirements for each degree. Write for Bulletin R-82.

Grantham College of Engineering
2500 So. LaCienega Blvd.
Los Angeles, California 90034



Complete Microprocessors line, peripherals & Terminals.

APPLE II PLUS, 48K	\$1215.00	Disk 130K DOS 3.3	
Pascal Lang Sys.	395.00	w/controller	\$575.00
Green Monitor	169.00	SOROC IQ 135	795.00
Leedex 100 Mon	139.00	TI-99/4	399.00
Visicalc	160.00	Epson MX-80	call us
Microsoft 2/80	320.00	Color Monitor	call us
IDS 445G	call us	TI-810	1395.00
TI-745	1440.00	80 Column Board	299.00

Texas Instruments

Invest. Anal	\$ 42.00	TI-59	\$175.00
Accessories	Call us	TI-55 II	39.95
TI-58C	80.00	Speak & Spell	49.95
PC100C	155.00	TI Programmer	47.95
TI BAIL	39.00	MBA	49.95

HEWLETT-PACKARD

HP/125 Computer	call us	HP-11C NEW	call us
HP/37E	\$60.00	HP-12C NEW	call us
HP-33C	70.00	HP-41C Mem Module	26.00
HP-34C	115.00	HP-41CV	call us
HP-38C	114.99	HP-67	295.00
HP-41C Prog	189.00	HP-97	570.00
HP-41C Printer	285.00	Quad Ram	call us
HP-41C CRD RDR	169.00	Application Pac	call us

HP-83 HP-85 and accessory - call us for prices

SCM TYPEWRITER SPECIALS

SCM 2200	\$279.00	INTREPID	\$274.00
SCM 2500	289.00	CLASSIC 12	159.00

All units shipped in original cartons with accessories according to manufacturer's specification. Send money orders, personal check 2 weeks to clear. In Illinois add 6% sales tax. Add \$6.95 minimum shipping & handling charges per unit. We ship UPS. Subject to availability. Written warranty for specific products can be obtained free upon request. Above prices are for mail order and prepaid only. Prices and specifications subject to change without notice. Send mail orders.

Nabik's, Inc.

519 DAVIS, EVANSTON, ILL. 60201 TEL. 312-869-6144

CREATE ANY RHYTHM

new improved memory



Our Popular Programmable Drum Set's simple programming system allows even first time users to structure bass, tom, snare, wood-block and clave sounds into any rhythm in any time signature. Versatile memory organization provides simultaneous storage of two separate rhythm patterns each with its own bridge rhythm. Bridges are activated from either the control panel touch plate or optional foot switch and are automatically synchronized to the main rhythm. Improved memory circuitry lets the "save" mode hold rhythm patterns for over one year while battery life for normal operation has been extended to several hundred hours.

In easy to assemble kit.

- () Send #3750 'Drum Set Kit, \$99.95 plus \$3 shipping enclosed.
- () Send Free Catalog.

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

VISA: _____ MC: _____ Card No. _____

BSA ELECTRONICS, DEPT 12R 1020 W WILSHIRE, OKLA CITY, OK 73116

CIRCLE 40 ON FREE INFORMATION CARD

COMPUTER CORNER

continued from page 90

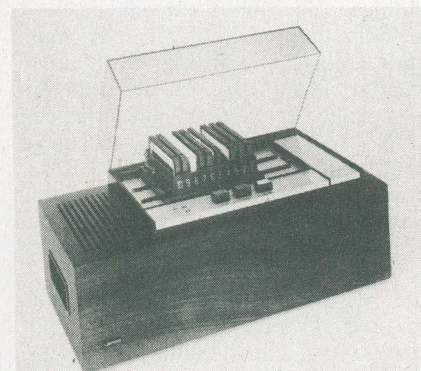
But how do you determine the quality of the software, and decide which program best fits your needs? Some companies offer demo disks, and that may be a good way to begin your shopping. The best way, however, is to ask someone who has used the software, and has dealt with the dealer. Reputable firms will be more than happy to give you some references. Speak with those users and find out how they used the software, and any problems that they may have had. Taking the trouble to do that can also save you some time in getting the software running if you do decide to buy it.

Also, while you are finding out about the software, make sure to ask about the producer and the dealer. Make especially sure to ask about the after-sale support: That is subject of the most often-heard complaints among computer users. Purchasing and setting up a computer system is not a simple matter of taking it home, plugging it in, and work. It requires education, experimentation, and a period of adjustment. Self-education before you make a purchase can help, but not as much as choosing a reliable vendor. **R-E**

NEW PRODUCTS

continued from page 104

CASSETTE CHANGER, model *RAC-10 MK II*, is an improved version of the model *RAC-10*, which has been in extensive use in hotels, restaurants, doctors' offices, department stores, and other areas where background music is required.



CIRCLE 127 ON FREE INFORMATION CARD

The model *RAC-10 MK II*'s extra refinements include volume-level control, automatic shutoff and pinch roller disengagement, and electronic noise-limiting circuitry. The frequency response is 35 Hz-14 kHz \pm 3 dB. It is priced at \$850.00 — **Benjamin Electropducts, Inc.**, 180 Miller Place, Hicksville, NY 11801. **R-E**

HI-FI MINI SPEAKER

continued from page 63

made from particle board or plywood. The supports are made from square lengths of wood. Dimensions are given in the Parts List. With the exception of the screws required to hold the sides of the enclosure together, to mount the speakers, and to connect the support-ends to their attachment points, glue can be used to secure one piece of the enclosure to the other. A hot-melt glue gun and glue sticks are recommended.

The L-pads, crossovers, and terminals should be mounted before the rear panel is installed—it would be virtually impossible to work on them afterwards. The mid-range speaker should be mounted off-center to prevent standing waves from developing and its enclosure should be filled with an acoustic insulating-material such as fiberglass. Glue the crossover coil and capacitors in place so they will not shift when the speaker is moved.

Partition 1 (see Fig. 2 for partition numbers) has two smaller partitions mounted on it to prevent standing waves. A thin layer of fiberglass, not more than 1/4-inch thick, should be placed over the entire partition-1 assembly, again to aid in preventing standing waves.

Finally, remember that the enclosure and sub-enclosure joints must be air-tight for the mini-SAFE speaker to work properly. Bear that in mind when you glue your joints!

Now for the assembly instructions—read them thoroughly before you begin:

1. Cut all parts to size, using the dimensions given in the Parts List and Fig. 6. Don't forget the 4-inch-square center holes in partitions 2, 4, 6, and the enclosure bot-

tom; and the holes for the speakers and L-pad shafts (see step 11).

2. Using four partition supports, mount partitions 1 and 3 on partitions 2 and 4, respectively.
3. Mount four partition supports on partition 6. *Do not* mount partition 5 at this time!
4. Mount the two squares on top of partition 1.
5. Assemble the four-sided tube.
6. Attach the four bottom supports to the enclosure bottom.
7. Attach the four top supports to the enclosure top.
8. Place the enclosure's front, rear, and side pieces on a flat surface. Assuming that the sides facing up will become the inside of the enclosure, use a marking pen to indicate the function of each piece ("front," "left side," etc.). Also indicate which end of each piece will be at the bottom.
9. Draw three parallel lines on each panel as shown in Fig. 7.
10. Attach the front and sides to the enclosure bottom. *Do not* attach the rear panel yet.
11. Mount and connect all the crossover components, L-pads, binding posts, and the mid-range speaker in the sub-enclosure bottom. Use the area between the enclosure bottom and the lower lines on the inside of the front and sides for this so that the square tube will be able to fit into its center hole in the enclosure bottom.
12. Place the tube in the center hole in the enclosure bottom and glue it in place. Then fill the empty spaces in the sub-enclosures with a loosely-fluffed acoustical material such as fiberglass.
13. Attach the rear of the enclosure to the rest of the assembly.
14. Glue the partition mounting strips to the front, rear, and sides of the enclosure so that the bottom edge of each strip is even with the lowest line marked on the bottom of those panels. They should form an even

continued on page 141



ORGAN AND PIANO KITS

The most advanced — most versatile electronic instruments in the industry are now within most everyone's reach . . . because you build them yourself the easy and very exclusive WERSI way. Best of all, you'll save up to two-thirds the cost of a commercially built instrument.

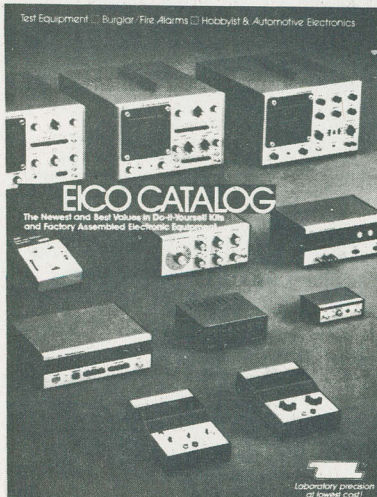
With WERSI's unique "Building Block" system, you actually select features you desire. Incorporate new features as they're developed. No need to trade organs again.

Send for free literature on this exciting concept today. (Please specify Piano or Organ) to:



Dept. M 21, P.O. Box 5318
Lancaster, PA 17601

The world of electronics gee-wizardry



-YOURS FREE.

32-pages of test instruments—from the latest digital multimeters to the famous EICO scopes. Security systems. Automotive and hobbyist products. Kits and assembled. EICO quality. EICO value. For FREE catalog, check reader service card or send 50¢ for first class mail.

EICO® 108 New South Road
Hicksville, N.Y. 11801

CIRCLE 80 ON FREE INFORMATION CARD

LETTERS

continued from page 13

tember 1981) to my letter in the June 1981 issue, but the editorial agreement with his arguments demands comment, so I must write again.

What efficient law enforcement, aimed at saving lives from irresponsible drivers, has to do with Hitler and "Big Brother" is beyond me. One need only look at the statistics on highway deaths caused by speeding to realize that some action must be taken. I agree that a computerized ticketing system should be designed carefully, to avoid abuse; but when we talk about saving lives, we have to look where the greatest risk is. People who think that the law should have no authority over them are not only killing themselves, but millions of other people who respect those laws.

I oppose too much big government as much as anyone else; but people like Mr. Recob are demanding it. Laws exist for a reason. Just because you disagree with a posted speed limit does not give you the right to ignore it; and claiming that enforcement is an invasion of privacy is no excuse.

No—radar is not 100% foolproof. (It's so unreliable that it is used at nearly every airport and military base in the world. The police are using a simplified version, but the same principles of physics apply there.) Like any other high-technology device, radar requires proper training for correct use. Of course, such training should be required by law for all police radar operators. But to argue against a technology because untrained (or poorly trained) persons make mistakes in using it is absurd. By that kind of fuzzy logic, we should condemn all other kinds of electronics, too. Even with the poor training programs in existence in some (but by no means all) areas, errors are the exception rather than the rule.

Mr. Recob says: "...a receiver is still a receiver, whether it provides communications or not." But to be protected by an unforeseen loophole in the *Communications* Act, the communications aspect is obviously the key issue. At the very least, certain types of receivers can (and should be) banned from moving vehicles. No one has any objection to Mr. Recob's (or anyone else's) using a radar detector in his bedroom. But it shouldn't be used in public to break laws when such violations clearly endanger life and limb.

His comment, "...our only defense is offense: radar detectors..." would be funny, if it wasn't so frightening. If you are driving within the local legal speed limit, a radar detector is of no use to you at all! It only tells you that you are being watched at that moment. What can you do with that information? If you've been driving carefully and observing the law, nothing—you do nothing at all—you just continue as you were.

Still support radar detectors? Read over the latest highway death statistics and notice the percentages caused by speeding. And sleep well, if you can.

DELTON T. HORN,
Hollywood, FL

R-E

Nine

SUPER DEALS FROM THE BACH COMPANY

1. Texas Instruments TI 99/4A Home Computer. Powerful TI Basic. Up to 72K total memory capacity. NEW typewriter keyboard. We carry *all* accessories. **\$369.95.**
2. Texas Instruments TI 59C. Programmable Calculator. With magnetic card storage. **\$189.95. \$20 Rebate Program.**
3. Texas Instruments TI 58C. Programmable Calculator. **\$89.95.**
4. Texas Instruments TI 100C. Printer/Plotter for TI 58C, TI 59C. **\$159.95.**
5. Texas Instruments TI Thermal Paper for 100C. 3 pack. **\$9.95.**
6. Hewlett-Packard Quad Memory Module. Converts HP-41C to HP-41CV capabilities. **\$89.95.**
7. Hewlett-Packard HP-41CV Alphanumeric Full Performance Programmable with Expandable Continuous Memory. **\$269.95.**
8. Hewlett-Packard HP-34C. Advanced Programmable Scientific Calculator with Continuous Memory. **\$119.95.**
9. Hewlett-Packard HP-38C. Advanced Financial Programmable Calculator with Continuous Memory. **\$119.95.**

ORDER TOLL FREE 800-227-8292

California Residents call 415-494-1995. Use VISA, Mastercharge, Check or money order. Indicate card number and expiration date. Add \$2.50 for shipping.



**The BACH
Company**

P.O. Box 51178
Palo Alto, CA 94303



CIRCLE 73 ON FREE INFORMATION CARD

DECEMBER 1981

MARKET CENTER

LIVE VIA SATELLITE TV NOW!

UNDER \$300
DISH TVRO
ANTENNA
FOR ROOF
OR PORCH



• **DISH ANTENNA** MOD. #2525
• **PREAMPLIFIER** MOD. #1202
• **RECEIVER** MOD. #3602 MDS COMPLETE RECEIVING SYSTEM

\$399

JUST PUBLISHED: 8 1/2 X 11 BOOK gives a wealth of updated information on • Antennas • Receivers • Low Noise Amplifiers • Sources • Services • Equipment • Manufacturers • Much More.

Our book takes the mystery out of the sophisticated technology of satellite transmission and reception. This volume represents all the essential knowledge **made easy to understand**, and will show you how easy it is to have a 90 channel reception system so that you can enjoy: first run movies, foreign films, Las Vegas entertainment, live sports, and much more. Everything being telecast in the world could be yours at a twist of a knob!

LIVE VIA SATELLITE, INC.

P.O. Box 2561, Dept. R-12, Delray Beach, FL 33444

Send \$9.95 plus \$2.50 shipping & handling or call our 24 hr. C.O.D. order line (305) 845-4447

Name _____

Address _____

PLANS & KITS

CABLE TV converters and equipment. Plans and parts. Build or buy. For information send \$2.00. **C & D ELECTRONICS**, PO Box 21, Jenison, MI 49428

GOOD money in computer field. Valuable new handbook, "How To Break Into The Computer Field," \$8.95. Moneyback guarantee. **CARRON PUBLISHERS**, 205-GA Ridgewood, Easton, PA 18042

SUBSCRIPTION TV plans: 2300 MHz microwave downconverter plus bonus UHF system, both for only \$10.00. Best systems available, no internal connections to TV! Parts and kits available, MC/Visa accepted on parts purchases. Send **SASE** for more information on these and other unique plans. **COLLINS ELECTRONICS**, Box 6424, San Bernardino, CA 92412

SATELLITE TVRO parabolic aluminum dish. Local

materials \$500. Plans, formulas \$10.00. **WARD MICROWAVE**, Box 100, Conway, NC 27820

WOLF whistle . . . great gag gift! CMOS. Schematic \$2.50. **BARRETT**, Box 663, Carrollton, TX 75006

SONAR distance ranging in air. LED display or simple microprocessor interface—great for robotics! Detailed plans \$5.95. **SENSYSTEMS**, P.O. Box 1497, Cupertino, CA 95015

DECODE Morse, RTTY, and ASCII signals from airwaves with new **Code*Star**. LED readout or connect with your computer/printer. Keyboard, other items also available. Kits or assembled. **MICROCRAFT**, Box 513R, Thiensville, WI 53092 (414) 241-8144

PRINTED circuit boards from sketch or artwork. Kit projects. Free details. **DANOCINTHS INC.**, Box 261, Westland, MI 48185

AMATEUR, instructional TV—2100-2600 MHz

To run your own classified ad, put one word on each of the lines below and send this form along with your check for \$1.65 per word (minimum 15 words) to:

Radio-Electronics, 200 Park Avenue South, N.Y., N.Y. 10003

ORDER FORM

PLEASE INDICATE in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of \$10.

() Plans/Kits () Business Opportunities () For Sale
() Education/Instruction () Wanted ()

Special Category: \$10

(PLEASE PRINT EACH WORD SEPARATELY, IN BLOCK LETTERS.)

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

PLEASE INCLUDE FOR OUR FILES YOUR PERMANENT ADDRESS AND PHONE NUMBER.

downconverter kits—\$49.95. Variable DC power supply kits—\$24.95. Complete system, all parts included—\$79.95. **NEC 64535** transistors—\$9.95. Complete plans and assembly instructions—\$2.95. Kits not available in Oklahoma. **GIGATRONICS**, 5004 Alan, Oklahoma City, OK 73135

MUSICAL car horn 64 tunes. No chips to buy. Kit with case less horn, \$39.95. Factory assembled with horn, \$59.95. Add \$1.75 shipping. **ELECTRONIC SOUND**, P.O. Box 401951, Garland, TX 75040

AUDIO kits. Equalizer—twelve bands/channel \$100; 24, \$225; noise reducer/expander, \$110; LED meter, \$42; see **R-E** cover stories 5/78, 3/81, 2/80, or send stamp for catalog. **SSS**, 912R Knobcone, Loveland, CO 80537

PCB 2:1 negatives to 11X14 \$20.00. For positives add \$10.00. Add your artwork postage. **REIS ELECTRONICS, INC.**, 1043 S. York #10, Bensenville, IL 60106

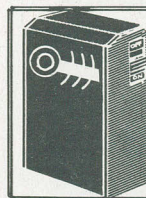
MICROWAVE television "downconverters" under \$50.00. High quality, easily assembled. Catalogue: \$2.00 (refundable). **NDS**, Box 12652-R, Dallas, TX 75225

SAVE 90%. Build your own micro or minicomputer. Free details. **DIGATEK CORPORATION**, Suite E, 2723 West Butler Drive, Phoenix, AZ 85021

ELECTRONIC catalog. Over 4,500 items. Parts & components. Everything needed by the hobbyist or technician. \$2.00 postage & handling (United States only), refundable with first \$15.00 order. **T & M ELECTRONICS**, 472 East Main Street, Patchogue, NY 11772 (516) 289-2520

MICROWAVE television education manual! New publication explores concepts, antennas, downconverters: \$16.25. Information package on microwave and other exciting television products: \$2.00. **ABEX**, P.O. Box 26601-RM, San Francisco, CA 94126

PCB. 15¢ sq-in. Free drilling. Satisfaction guaranteed. **INTERNATIONAL ENTERPRISE**, 6452 Hazel Circle, Simi Valley, CA 93063



MINI FM MIC

Compact size, only 2"x1"x3/4". Transmit to FM radio 88-108 MHz. Exceptional audio quality. Transmits stable signal up to 900 ft. Complete kit incl. case, battery & instructions. Only \$13.95. Assembled \$18.95. Add \$1.55 S&H ea. Send 18¢ stamp for brochure.

S.E. Corp., Box 16969-R
Temple Terrace, FL 33687



ELECTRONIC ORGAN KITS

3-4 Manuals

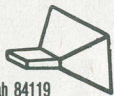
THEATER and CLASSICAL

Refundable Parts

Wurlitzer reproductions Brochure \$2.00 Catalog \$1.50
DEVTRONIX ORGANS, INC., Dept 60
6101 WAREHOUSE WAY, SACRAMENTO, CA 95826

MICROWAVE HORN ANTENNA KIT

1.7-26 GHz Frequency Range 17-19 db Gain Kit w/Assembly Instructions \$39.95*
Down Converter Board \$19.95* (w/Antenna Kit \$14.95)
Parts Kit for Board \$29.95* (w/Antenna or Board \$24.95)
Complete Package (Antenna, Board & Parts Kit) \$79.95



MICROTEENNA ASSOCIATES

2335 South 2300 West, Salt Lake City, Utah 84119
Check or M.O. only — Allow 2-4 Weeks Delivery (Cost includes shipping)
*Utah Residents Please Add 5% Sales Tax

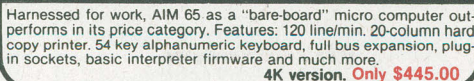
FREE KIT Catalog

FUNCTION GENERATOR KIT \$59.95
Auto-Ranging Cap-meter kit \$79.95
Phone 415-447-3433
Write or Phone for FREE CATALOG.
Average 1 minute Saturday call is 21¢.

contains
TEST &
EXPERI-
MENTER'S
EQUIP.

DAGE SCIENTIFIC INSTRUMENTS
BOX 1054R LIVERMORE CA 94550

Write for your free catalog.
See address below.



ACT NOW WHILE
QUANTITIES LAST



LM301AN/8	.32	SN76477NF	1.69	LM747CN/4	.50
LM307N/8	.43	LM348N/4	1.99	LM748CN/8	.48
LM308N/8	.59	LM358N/8	.48	LM1488N/8	.36
LM308CH	.59	LM555N/8	.28	LM1458N/4	.64
LM309K	1.56	LM555N/4	.52	LM1489N/4	.64
LM310C/8	1.03	LM741C/4	2.95	LM1489CN/4	2.21
LM311CH	.85	LM709CH	.59	LM1495CN/8	.64
LM311N/8	.49	LM714CH	2.95	LM221CN/4	1.95
LM318N/8	1.19	LM723CH	.78	LM2240CP	2.80
LM319C/4	1.03	LM741C/4	2.95	LM3038	1.67
LM323K	5.34	LM725CN/8	1.22	LM3038C/4	1.67
LM324N	.48	LM733CN/4	1.36	LM3524PC	3.30
LM336N	.48	LM739CN/4	1.69	LM3909N	.98
N8T26N	1.29	LM741CN/8	1.69	LM4136N/4	.98
LM339N	1.29	LM747CN/8	1.69	LM4136N/8	.98

LED 209	.09
LED 211	.19
LED 212	.14
TII 209A	14

LED 220	.15
LED 222	.24
LED 224	.16
TII 220	.15

CD4001BE	.22	CD4040BE	.64	CD4108BE	1.66
CD4002BE	.18	CD4041BE	.89	CD4108LE	.50
CD4006BE	.59	CD4042BE	.54	CD4511BE	.50
CD4007BE	.28	CD4043BE	.76	CD4512BE	.77
CD4008BE	.67	CD4044BE	1.52	CD4514BE	.68
CD4009BE	.69	CD4045BE	.79	CD4515BE	1.68
CD4010BE	.39	CD4047BE	.72	CD4516BE	.77
CD4011BE	.22	CD4049BE	.38	CD4519BE	.53
CD4012BE	.18	CD4050BE	.32	CD4520BE	.50
CD4013BE	.38	CD4051BE	.79	CD4522BE	.77
CD4014BE	.56	CD452BE	.79	CD4526BE	1.21
CD4015BE	.66	CD4527BE	1.52	CD4527BE	1.52
CD4016BE	.32	CD4068E	.89	CD4528BE	.67
CD4017BE	.54	CD4068EE	.54	CD4531BE	.81
CD4018BE	.52	CD4068BE	.24	CD4532BE	.88
CD4019BE	.58	CD4069BE	.25	CD4539BE	.50
CD4020BE	.68	CD4070BE	.29	CD4543BE	1.41
CD4021BE	.57	CD4071BE	.29	CD4543CE	2.88
CD4022BE	.19	CD4072BE	.19	CD4555BE	.50
CD4023BE	.19	CD4073BE	.28	CD4556BE	.55
CD4024BE	.44	CD4075BE	.28	CD4581BE	1.88
CD4025BE	.40	CD4076BE	.58	CD4582BE	.66
CD4026BE	1.45	CD4077BE	.28	CD4584BE	.77
CD4027BE	.42	CD4081BE	.25	CD4585BE	.77
CD4028BE	.54	CD4082BE	.19	CD4702BE	10.33
CD4029BE	.38	CD4083BE	.47	CD4083BE	.47
CD4030BE	.38	CD4086BE	.59	CD4089CP	.59
CD4033BE	1.67	CD4093BE	.56	CD4016CP	1.21
CD4034BE	2.44	CD4099BE	1.75	CD4017CP	1.21
CD4035BE	.68	CD4101BE	2.38	CD4025CP	.68



Part No.		Price
2101-35	IK (256 x 4) 350NS 22 PIN	1.65
2102-25	IK (IK x 1) 250NS 16 PIN	1.25
P2111-45	IK (256 x 4) 450NS 18 PIN	2.65
P2112-35	IK (256 x 4) 350NS 18 PIN	2.65
2114L	Low Power 4K (1024 x 4) 300NS	2.95
2147	4K (4K x 1) 55NS	8.95
2147	4K (4K x 1) 70NS	7.45

AY5-1013A *Special 3.95*
40 Khz Single 5V Supply

1404A	(TO-5)	single 1024 bit	2.9
3341APC	FIFO 1 MHz		4.4
3342PC	64 Bit		3.9
3347PC	80 bit		3.4

XR210CP	PHASE-LOCKED LOOPS
XR215CP	FSK Modulator/Demodulators
XR2212CP	High Frequency Phase-Locked Loop
XR2567CP	Precision Phase-Locked Loop
	Dual Monolithic Tone Decoder

XR205CP	Monolithic Waveform Generator
XR2206CP	Monolithic Function Generator
XR2207CP	Voltage-Controlled Oscillator
XR2209CP	Precision Oscillator
XR8038CP	Precision Waveform Generator

TIMING CIRCUITS	
XRL555CP	Micropower Timing Circuit
XRL556CP	Dual Micropower Timing Circuit
XR558CP	Quad Timer Circuit
XR2556CP	Dual Timing Circuit
XR2242CP	Long Range Timer

XRL555CP	Micropower Timing Circuit
XRL556CP	Dual Micropower Timing Circuit
XR558CP	Quad Timer Circuit
XR2556CP	Dual Timing Circuit
XR2242CP	Long-Range Timer

80A CPU	4.95	6808 CPU	
85 CPU	7.95	6809 CPU	1
55	9.00	6810	
12	2.25	6820	
14	4.25	6821	
16	1.98	6845	2
24	3.44	6850	
26	2.34	6852	
28	4.97		
51	5.95	6502 CPU	
53	9.95	6504 CPU	
55	5.95	6505 CPU	
57	9.95	6520	
59	9.95	6522	
79	10.95	6532	1
48	36.00	6551	1
55	32.00		

S288	1.88	256 bit, 16 PIN
S188	1.88	256 bit, 16 PIN
A427/82S129	2.75	1K, 16 PIN
A417/82S126	2.75	1K, 16 PIN
A446/7621	4.95	2K, 16 PIN
A436/7620	4.95	2K, 16 PIN
A453/7643	6.95	4K, 18 PIN
A448/7641	7.95	4K, 24 PIN
A451/82S181	17.95	4K, 24 PIN
S185/7128	17.95	8K, 18 PIN
A478/7132	19.84	8K, 24 PIN
S191/7138	78.00	16K, 24 PIN

4164 64K (64K x 1) 200NS 16 PIN	\$24.00
--	----------------

PINS	PRICE	PINS	PRICE
8	.08	22	.22
14	.14	24	.24
16	.16	28	.28
18	.18	40	.40
20	.20		

PINS	PRICE	PINS	PRICE
8	.33	24	.99
14	.50	28	1.11
16	.55	36	1.60
18	.69	40	1.50
20	.80		

7400N	23	74339N	.38	741040N	.64	741150N	.52	741978N	.72	745050N	.69	7451533N	1.10	7452800N	2.29	741326N	.39	7415100N	.36	7415170N	1.56	7415259N	1.29	7415375N	.64
7401N	25	74400N	.25	7410740N	.44	741608N	.48	741988N	1.50	745080N	.48	7451571N	1.10	7452833N	3.39	741527N	.29	7415129N	.36	7415173N	.59	7415260N	1.25	7415378N	1.25
7402N	24	74424N	.44	741090N	.44	7416124N	.64	741995N	1.55	745090N	.86	7451588N	1.16	7452998N	6.54	7415300N	.18	7415122N	.48	7415174N	.44	7415266N	.36	7415378N	.99
7403N	24	74458N	.95	741101N	.52	7416216N	.64	742221N	.68	745100N	.88	7451616N	4.74	7453733N	2.98	7415320N	.29	7415123N	.59	7415175N	.44	74152733N	1.19	7415378N	1.09
7404N	26	74468N	.84	741111N	.72	7416334N	.64	742465N	1.44	745115N	.59	7451628N	3.70	7453742N	1.44	7415333N	.29	7415124N	.44	7415176N	.44	74152733N	1.19	7415378N	1.09
7405N	26	74488N	.76	741121N	.88	7416458N	.64	742613N	1.28	745135N	.68	7451638N	4.74	745381N	1.95	7415338N	.29	7415125N	.44	7415178N	.44	74152733N	1.19	7415378N	1.09
7406N	36	74505N	.25	741200N	1.38	741656N	.64	742513N	.79	745200N	.48	7451688N	4.74	7454122N	2.98	7415342N	.44	7415126N	.54	7415190N	.72	7415280N	1.96	7415395N	1.19
7407N	36	74515N	.29	741212N	.48	741666N	.68	7425918N	1.89	745300N	.48	7451691N	5.39	7454711N	6.45	7415347N	.68	7415133N	1.68	7415191N	.72	7415283N	.76	7415447N	.37
7408N	26	74535N	.29	741222N	.54	741700N	1.96	742733N	2.39	745320N	.89	7451748N	1.06	7454722N	8.45	7415351N	.99	7415136N	1.68	7415192N	.64	7415283N	.72	7415447N	.37
7409N	26	74548N	.48	741232N	.48	741710N	1.96	742743N	2.39	745340N	.89	7451758N	1.06	7454733N	8.45	7415351N	.99	7415136N	1.68	7415192N	.64	7415283N	.72	7415447N	.37
7410N	25	74723N	.36	741252N	.52	741737N	.79	742787N	2.38	745380N	1.17	7451813N	3.95	7454767N	5.95	7415354N	.24	7415139N	.48	7415194N	.64	7415288N	.86	7415669N	.84
7412N	47	74733N	.38	7412648N	.48	741747N	.66	742797N	.59	745400N	.44	7451828N	2.10	7454767N	5.95	7415355N	.24	7415145N	1.09	7415196N	.86	7415299N	2.50	7415670N	1.84
7413N	42	74743N	.36	741282N	.64	741755N	.58	742833N	1.10	745515N	.69	7451889N	4.95	7415360N	.19	7415373N	.32	7415147N	1.06	7415197N	.86	7415320N	2.75	7415670N	1.84
7414N	42	74743N	.42	741320N	.45	741768N	.77	742933N	.89	745548N	.69	7451901N	4.95	7415361N	.19	7415373N	.32	7415147N	1.06	7415197N	.86	7415320N	2.75	7415670N	1.84
7415N	36	74763N	.36	741320N	.45	741768N	.77	742933N	.89	745548N	.69	7451901N	4.95	7415361N	.19	7415373N	.32	7415147N	1.06	7415197N	.86	7415320N	2.75	7415670N	1.84
7417N	36	74834N	.48	741418N	.84	741791N	1.35	743513N	2.20	745866															

Add \$3.00 to cover postage & handling VISA AND MASTERCARD ACCEPTED



CIRCLE 3 ON FREE INFORMATION CARD

NEED A COMPACT ANTENNA?

McKAY SETS THE STANDARD

with the DA100D Outdoor Antenna
and the DA9-DL4 Combination
Indoor Loop Antenna

For specs and details contact dealers:

HARVEY RADIO New York City
HENRY RADIO Los Angeles CA
BARRY ELECTRONICS New York City
GILFER ASSOCIATES Park Ridge New Jersey
ELECTRONIC EQUIPMENT BANK (D.C. area) Vienna VA
BRIDGEWATER CUSTOM SOUND Harvey, ILL.
AUDIO PERFECTION Bloomington MINN
STANDARD SUPPLY CO. Salt Lake City Utah
THE BASE STATION Concord CA
J-MAR ELECTRONICS Toronto Canada

800/854-7769 Local 714/621-6711
except CA, Alaska, Hawaii TWX 910-581-4990



McKAY DYMEK COMPANY
111 S. College Ave. P.O. Box 5000
Claremont CA 91711 U.S.A.



REEL TO REEL TAPE

OPEN reel tape—mostly Ampeg, used once, unspliced, (unboxed) 7" 1800' or 2400'—50 reels for \$60.00 (postpaid) 3600' 10 1/2" reels \$2.00 each. Sample reel \$1.50. **AUDIO TAPES**, Box 9584-G, Alexandria, VA 22304

ELECTRONIC NEWSLETTER

ELECTRONIC Systems Newsletter will change the way you design and build electronic equipment. Unique monthly publication packed with ideas, sources and techniques. 12 fascinating issues, \$19 (1 year). CCI, Dept. RE1, P.O. Box 329, So. Hadley, MA 01075

SATELLITE TV

Make your first investment in Satellite TV the intelligent one!

* **Complete Handbook & Buyers Guide** - detailed, yet simple to understand. Includes equipment costs, kits, turnkey manufacturers — \$7.95.

* **Comp-Sat Location Analysis** - 6-page computer print out locates all 11 satellites. A must for any station. Send zip code, longitude & latitude or nearest intersection. — \$9.95.

* Both of the above for only \$16.95.

INTERNATIONAL COMMUNICATIONS CO.
P.O. Box 25036 - CHARLOTTE, N.C. 28212



Latest microstrip model of the "original"
MICROWAVE TV SYSTEM KIT

- LT-13 Down Converter with Preamp
- 16 dBi Slotted Antenna
- Deluxe Power Supply Kit
- All Coaxial Cables Included
- 2000 - 2600 MHz Tuning Range



LAB-TRONICS, INC.
P.O. Box 171
Rogers, MN 55374
612-428-4226

SATELLITE TELEVISION

SATELLITE super-mixer; DBM-4150A. Clean up your TRVO receiver! Near-theoretical performance; flat response, DC-1500IF, SMA connectors; \$69.50—CK/MO/COD. **RIGEL SYSTEMS**, 2974R Scott Blvd., Santa Clara, CA 95050 (408) 727-4231

SATELLITE TV. Books, parts, low-noise microwave transistors. Specs and catalog \$2.00. **ELITE ELECTRONICS**, RR1, St. George, Ontario, Canada N0E 1N0

SATELLITE TV antenna aiming. Lock on all visible satellites with polar mount. Accurate alignment now possible with our unique **Sun Compass** tables. Optimum pole axis, mount declination, satellite azimuth and altitudes, and one month **Sun Compass** table computed for your position... \$12.00. **VERSCHIEDEN**, Box 12178, Boulder, CO 80303

SATELLITE TV antenna, 10 ft. fiberglass, complete, polar mount, \$1950.00, electronics at cost also. **TRI-STAR COMMUNICATIONS**, Box 843, Erie, MI 48133 (419) 726-1095

Enjoy Satellite TV Now



Better than Cable TV—Over 200 TV and radio services. Why waste money? Learn the whole story and build a video system the family can enjoy. No commercials, **FREE** movies, sports and Vegas shows—worldwide, crystal clear reception connects to any TV set. Big (8 x 11 in.) book loaded with details, photos, plans, kits—**TELLS EVERYTHING! Satisfaction Guaranteed.**

Send \$7.95 TODAY! Add \$2.00 for 1st class (air mail) or call our 24 hour C.O.D. rush order line (305) 862-5068.

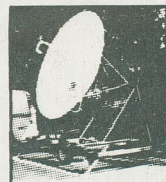
GLOBAL ELECTRONICS,
P.O. Box 219-E, Maitland, Florida 32751

Satellite TV

FOR THE HOME

Sick of Network TV?

Our receiver lets you get over 75 channels of television directly from earth-orbiting cable TV satellites! HBO, Showtime, super stations, sports and movies worldwide.



**We don't just
sell information!
We Manufacture
Hardware!**

Technical information book and catalog gives you all the facts. Inexpensive dishes, feeds, telemetry software, kits and more. Recommended reading by NASA, The Office of Consumer Affairs and quality companies like Rockwell/Collins. Send \$7.95 today!

CALL
24-hrs. C.O.D. Hotline
(305) 339-7600

© **SPACECOAST**
RESEARCH CORPORATION
P.O. Box 442-E, Altamonte Spgs, FL 32701

ATV Research ...specialists in CCTV and computer monitors!

Video monitors - color & B/W * TV Cameras, kits, parts & plans * Video-to-RF modulators * Free catalog. Phone or write. (402) 987-3771

13-RE Broadway Dakota City, NE. 68731

Fall & Winter '81 - TEST EQUIPMENT Electronic Component Catalog

FREE 160 Page Book

We carry the Following:

- TEST EQUIPMENT**
- B & K
 - LEADER
 - VIZ
 - BECKMAN
 - HITACHI
 - GLOBAL SPECIALTIES
 - DATA PRECISION
 - HICKOK

ELECTRONIC COMPONENTS

- JAPANESE & MOTOROLA Transistors
- IC's, FET, Diodes
- Capacitors
- Resistors
- Connectors, Cables

TOOLS

- Weller, Ungar, Xcellite, Vaco, etc.

SEEKING ELECTRONIC COMPONENTS
AT WHOLESALE COST

半導体

FALL CATALOG 1980

SELECT FROM OUR LARGE
INVENTORY READY TO SHIP

O.E.M. INQUIRIES WELCOME

FUJI-SVEA INC.

- Over 10 million components in stock to serve you
- Over 20,000 sq. ft. of warehouse in the East & West
- NO MINIMUM ORDER!



FUJI-SVEA®
P.O. Box 40325 Cincinnati OH 45240
Dept. Radio-Electronics

CALL TOLL FREE
800-421-2841
Local: 513-874-0220
Telex: 182 392

Name _____ Phone _____
Company _____
Address _____
City _____ State _____ Zip _____

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

BUSINESS OPPORTUNITIES

LIFETIME security in computer field. Valuable new handbook, "How To Break Into The Computer Field," \$8.95. Moneyback guarantee. **CARON PUBLISHERS**, 205-GC Ridgewood, Easton, PA 18042

15A programmable control timer—0.6" LED display, LSI circuitry, 4 on-off cycles, presettable, etc. US\$25.00. Data US\$5.00 (credit first order). **RELIANT ENGINEERING COMPANY**, PO Box 33610, Sheungwan, Hong Kong

\$700 per month earnings possible filling out income tax forms at home or tax office during tax learned. Details mailed free. No salesmen. Hurry. Big demand. **FEDERATED TAX**, 2015 Montrose, Chicago, IL 60618

CB RADIO

GET more CB channels and range! Frequency expanders, boosters, speech processors, how-to books, plans, modifications. Catalog \$2. **CB CITY**, Box 31500RE, Phoenix, AZ 85046

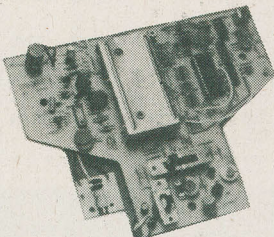
SURPLUS ELECTRONICS CORP.

7294 N.W. 54th Street
Miami, Florida 33166

WHOLESALE/RETAIL

EQUIPMENT/COMPONENTS/WIRE & CABLE/ACCESSORIES

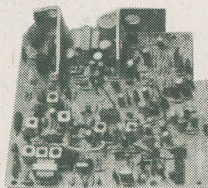
Phone: (305) 887-8228
TWX: 810-848-6085
We accept MasterCard and Visa.



"TANK BATTLE" TV GAME

In just a short time and with a few minor parts, the most novice hobbyist can complete this exciting Tank Battle game. Create a fun-filled evening for the whole family. Two independent tanks rumble thru land mine fields, shoot shells and fragment when hit. Four distinct engine sounds are produced for the different speeds. Sounds of gunfire, shell bursts and tank explosions are realistic. Automatic on-screen scoring. Supplied with schematic drawing.

SOLD AS IS
\$9.95 ea.



C.B. SPECIAL

CONVERT THESE TO 10 METER FM

New HY-GAIN printed circuit board assembly with PLL02A chip and 3 crystals. (Squelch pot, volume control and channel switch not included.) Boards sold as is, the way we bought them from the manufacturer. Board dimensions 6" x 6 1/2"

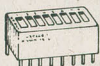
1-9 **\$7.50**
10-49 **\$6.50**
50-99 **\$6.00**
100-UP **\$5.50**

COPPER CLAD BOARD (Double Side)

Size 9.25 x 10.75
Thickness .062

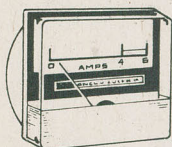
\$2.00 ea.

DIP SWITCH



5 POSITION **\$1.00 ea.**
8 POSITION **\$1.50 ea.**
10 POSITION **\$2.00 ea.**
12 POSITION **\$2.50 ea.**

AMP METERS



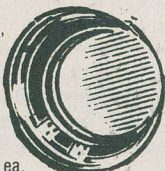
2 1/4" square, no shunt required.
Easy to read dial.

Movement: 0-6, 0-10, 0-17

\$2.50 ea.

SPEAKER

3" Diam.,
8 OHM,
5 Watts.



\$2.00 ea.

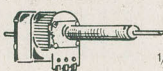
TRIMMER CAP



1.5-20pF
(ARCO PC-402)

50¢ ea.

SUB-MINI 10K POT



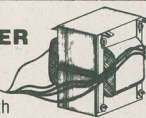
with On-Off
1/4" hole mount,
1/8" D shaft,
3/4" thread section.

5/\$1.00

POWER TRANSFORMER

\$14.95 ea.

Primary - 115 vac
Secondary - 32 v with
24 v tap at 15 amps
Dim. 4 1/2" h X 3 3/4" w X 4" deep



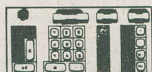
SCREW DRIVER KIT



Handle stores four blades
2 single slot 5/32" & 3/32"
1 phillips 1 scratch awl
6" long with one blade inserted

\$1.00 ea.

TEXAS INSTRUMENT KEYBOARD



Has 3 slide switches, 26 different
keys, key pad removable by 4 screws

\$1.95 ea. 5/\$8.00

E. F. JOHNSON S METER



Edge Meter 250 UA,
fits in 5/8" x 1 1/8" hole.
Black background.
Scale 1-20 Top,
0-5 Bottom.

\$1.25 ea. 5/\$5.00

COMPUTER GRADE ELECTROLYTICS

VALUE/MFD	VOLTS	DIAM./LGTH.	PRICE
63,000	@ 15V	3" x 5 1/2"	\$4.00 ea.
10,000	@ 20V	1 1/2" x 5 3/4"	\$3.00 ea.
2,700	@ 25V	1 1/4" x 2 1/4"	\$2.00 ea.
2,900	@ 25V	1 1/4" x 2"	\$2.00 ea.
100,000	@ 30V	3" x 5 1/2"	\$6.00 ea.
39,000	@ 30V	1" x 5 3/4"	\$4.00 ea.
34,800	@ 50V	3" x 5 1/2"	\$3.00 ea.
450	@ 75V	1 1/4" x 2 1/4"	\$2.00 ea.
500	@ 100V	1 1/2" x 3 1/4"	\$2.00 ea.
240	@ 300V	1 1/4" x 3 1/4"	\$2.00 ea.
50	@ 450V	1 1/4" x 2"	\$2.00 ea.

24 Volt POWER SUPPLY 5.4 AMPS



\$45.00 ea.

MFG by ACDC Electronics Inc.
Model OEM 24N5.4-1

Input 105-125 vac 50/60 Hz.
Has volt adj and O.L. adj.
Output terminals contain
+ out, + sen, - sen, - out, ac neut,
ac line and GND.

9 VOLT NiCd RECHARGEABLE BATTERY

NEW. Replaces
the popular 9V
Transistor Battery.



\$4.75 ea.

PROJECT BOX

\$1.50 ea.



4 5/8" w x 7 3/8" l x 3/4" to 1 1/2" h
Has a lip for recessed face
plate and a felt bottom

POWER SUPPLY



\$3.95 ea.

IC SOCKETS GOLD-PLATED WIRE WRAP



14 pin **40¢ ea.**
16 pin **45¢ ea.**
40 pin **\$1.75 ea.**

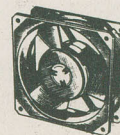
MAGNETIC CHESS BOARD WITH MEN

Folds in half to carry men
11" w x 11" l x 1" h

\$4.00 ea.



MUFFIN FANS



MFG By Rotron Inc.
3 Blades 4 3/4" Square

USED
110 VAC **\$5.95 ea.**

NEW
230 VAC Model MU3A1

\$12.00 ea.

NEW SPRITE FAN

Mfg. by Rotron Inc.
Model SU2A5
115v AC. 19 amps.
(Impedance protected.)
3 1/4" x 3 1/4" x 1 1/4"

\$12.00 ea.

7' POWER CORD HEWLETT PACKARD TYPE



Molded 3 Prong
Plug with molded
receptacle
Belden 16 AWG
\$3.00 ea.

COAX CONNECTORS

UG-273/U BNC-F/UHF-M **\$2.50**
UG-255/U BNC-M/UHF-F **\$3.00**
UG-146 A/U N-M/UHF-F **\$4.50**
UG-83B/U N-F/UHF-M **\$4.50**
UG-175 RG-58 Adapt **\$.20**
UG-176 RG-59 Adapt **\$.20**
UG-1094 BNC-F/Panel **\$1.00**

S0239 **50¢**
PL259 **60¢**

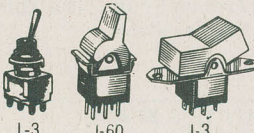
COAXIAL CABLE

50 OHM-RG 174

\$4.95/100' \$3.00/50'
75 OHM-RG 62/U

\$12.00/100'

C & K SWITCHES



Part #	Movement
J-60	SPDT
J-60	7101 SPDT
J-60	7103 SPDT (center off)
L-3	7108 SPDT (momentary)
J-3	7201 DPDT (special large rocker)

\$1.00 ea. 6/\$5.00

AXIAL LEAD ELECTROLYTIC CAPACITORS

2 uF @ 15V 12/**\$1.00**
10 uF @ 15V 12/**\$1.00**
20 uF @ 15V 12/**\$1.00**
50 uF @ 15V 12/**\$1.00**
2.2 uF @ 25V 12/**\$1.00**
3.3 uF @ 25V 12/**\$1.00**
1 uF @ 35V 12/**\$1.00**
2 uF @ 150V 12/**\$1.00**
25 uF @ 25V 15/**\$2.00**
3 uF @ 50V 15/**\$2.00**
5 uF @ 50V 15/**\$2.00**
10 uF @ 50V 15/**\$2.00**
250 uF @ 25V 10/**\$2.00**
50 uF @ 75V 10/**\$2.00**

MODEM CABLE ASSEMBLIES

\$5.50 ea.



Conn & Hood	22 AWG # Cond	Length
25 P	14	15'
25 S	10	17'

TERMS: All material guaranteed unless otherwise stated. If you are not satisfied with our product, it may be returned within 10 days for a refund (less shipping). Please add \$4.00 for shipping and handling on all orders. COD's accepted for orders totaling \$50 or more. All orders shipped UPS unless otherwise specified. Florida residents please add 4% sales tax. Minimum order, \$15.00. Foreign orders - US funds only, add 20% for shipping and handling.

TO GET DOWN TO BUSINESS,

A lot of companies claim to make business computers: we back up our claim with facts.

Speed•CompuPro gets jobs done faster.

While other computers poke along with 2 or 4 MHz system clocks, our machines run at 6 and 8 MHz for maximum throughput.

Freedom from obsolescence•Unlike all-in-one computers, CompuPro's S-100 bus design is easily expandable and upgradable. As your business grows, a CompuPro machine grows with you to protect your initial investment and maintain your competitive edge.

Reliability•There's a reason why we back our products with one of the best warranties in the business: Our products work. That's why systems integrators world-wide specify CompuPro components for important commercial, industrial and scientific applications. (Most boards are also available qualified under the Certified System Component high-reliability program.)

MOVE UP TO COMPUPRO.

CompuPro manufactures a complete line of proven S-100 components. Here are some of our most popular products:

Disk 1 DMA Disk Controller. Simply stated, there is no faster disk controller available today in the microcomputer business. IBM compatible format handles soft-sectored single or double-density, single or double-sided disks. Set up for 8" disks; also handles 5.25" types. With BIOS for CP/M® -80. Manual available for \$25. **\$495 assembled, \$595 CSC.**

CPU 8085/88. Executes the software of today and tomorrow by combining a 16 bit 8088 CPU and an 8 bit 8085 CPU. Already a standard in the software industry, CPU 8085/88's innovative design elegantly bridges the 8 and 16 bit worlds. **\$425 assembled (with 6 MHz CPUs), \$525 CSC (with 8 MHz CPUs).**

Spectrum Color Graphics Board. As Microsystems magazine says, "...considerably less expensive (than other units) and just as soul-satisfying". 8K of static RAM, I/O port for keyboard/joystick interface, and graphics generator. 10 modes of operation, from alphanumerics/semi-graphics in 8 colors to dense 256 X 192 full graphics. **Now on special: Only \$299 (assembled) for orders postmarked before 12/30/81.**

How to order: Call 415-562-0436 for the authorized CompuPro dealer near you, or to place factory direct VISA® /Mastercard® orders. Prices shown do not include tax, shipping, or dealer support services (if applicable).

CompuPro™

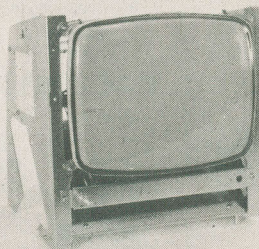
BOX 2355, OAKLAND AIRPORT, CA 94614

GODBOUNT
ELECTRONICS

CIRCLE 20 ON FREE INFORMATION CARD

VIDEO MONITOR by Hitachi, Ltd.
MODEL CD12 w/Documentation
80 CHAR./ 24 LINES/ 12" DIAG.
12 VDC (Standard Composit
Video Input)
NEW \$84.95 each
DYNAMIC RAM 4116/ 250ns PRIME
\$2.00 each 8 for \$15.00

OPTO ISOLATORS 5082-4360/6N137
Ref. JAN. 81 R-E \$4.95 each



ELECTRONICS PLUS

9600 Baltimore Blvd.
College Park, Md. 20740
Phone 301-441-9009

ADDITIONAL ITEMS IN STOCK BY VECTOR, ISOTIP, ORYX, OK, SPRAQUE, PANAVISE, VACO, HUNTER, PERMA POWER, BISHOP GRAPHICS, RAYOVAC, PHILMORE, LITTLE FUSE, RAYTHEON, HAMMOND, AMPHENOL, RUSTOLEUM, RAWN CHEMICALS, HOWARD W. SAMS, OSBORNE, A.W. SPERRY, LEADER, NON LINEAR SYSTEMS, GLOBAL SPECIALITIES AND TCG REPLACEMENT SEMIS, IC'S etc.

ALL ITEMS ADVERTISED R-E SHIPPED UPS POST PAID CONTINENTAL U.S.A., MASTER CARD AND VISA ACCEPTED. MD RESIDENTS ADD 5% SALES TAX.

CIRCLE 30 ON FREE INFORMATION CARD

COMPUTER MARKET CENTER

COMPUTER MARKET CENTER ADVERTISING RATES 1" by 1 column (1 5/8") \$55.00. 1 1/2" by 1 column (1 5/8") \$82.50. 2" by 1 column (1 5/8") \$110.00. All ads must be prepaid. Send order and remittances to Computer Market Center, **Radio-Electronics Magazine**, 200 Park Avenue South, New York, New York, 10003. Address telephone inquiries to 212-777-6400. Frequency rates are available.

TEXAS

USED COMPUTER TERMINALS,
PRINTERS, MODEMS, SUR-
PLUS ELECTRONIC PARTS.
CATALOG \$1.00

RONDURE COMPANY
THE COMPUTER ROOM
2522 BUTLER STREET
DALLAS, TEXAS 75235
(214) 630-4621

RETAILERS

An ad for your computer store in this space in Radio-Electronics COMPUTER MARKET CENTER puts you in touch with our computer audience. They use micro-computer equipment for both business and hobby interests. For further details call 212-777-6400.

BUY THIS SPACE

\$55.00 puts your ad in this space in front of 197,223 active Radio-Electronics readers. To place your ad write Computer Market Center, Radio-Electronics, 200 Park Avenue South, New York, New York 10003 or call 212-777-6400.

SUPPORT
MARCH
OF DIMES



Take stock in America.
Buy U.S. Savings Bonds.

Thanks to you,
it works.
For all of us.



United Way

DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY — DIGI-KEY

PANASONIC METALLIZED POLYESTER

NEW! KIT
100% POLYESTER CAPACITORS
 Price includes component, drilled plastic base with gold wire, free-form and work screws.

ASSORTMENT OF 15 POPULAR VALUES PARALLEL-CHUNKY HIGH REEL

Part No.	Working Voltage μF	Pak Of 15	Pak Of 15
E11100	100	23	1863
E11214	12	25	212
E11514	15	27	228
E11514	100	15	2728
E11514	220	15	2728
E11514	22	32	1886
E12714	27	32	2913
E13334	33	37	3118
E14714	47	39	3118
E14714	47	42	3285
E18214	46	47	4022
E18214	68	52	4444
E18214	82	58	4444
E1125	10	63	535
E1125	15	63	535
E1125	15	86	732
E1125	12	86	732

E-KIT NO. E-110
ONLY \$54⁹⁵

NEW! KIT
100% POLYESTER CAPACITORS
 Price includes component, drilled plastic base with gold wire, free-form and work screws.

ASSORTMENT OF 15 POPULAR VALUES PARALLEL-CHUNKY HIGH REEL

Part No.	Working Voltage μF	Pak Of 15	Pak Of 15
E11100	100	23	1863
E11214	12	25	212
E11514	15	27	228
E11514	100	15	2728
E11514	220	15	2728
E11514	22	32	1886
E12714	27	32	2913
E13334	33	37	3118
E14714	47	39	3118
E14714	47	42	3285
E18214	46	47	4022
E18214	68	52	4444
E18214	82	58	4444
E1125	10	63	535
E1125	15	63	535
E1125	15	86	732
E1125	12	86	732

E-KIT NO. E-110
ONLY \$54⁹⁵

11225	100	2.2	10.40	85.5	73.70	683.0
11226	100	2.2	10.40	85.5	73.70	683.0
11227	100	2.2	10.40	85.5	73.70	683.0
11228	100	3.3	1.35	11.50	95.5	692.0
11229	100	3.3	1.35	11.50	95.5	692.0
11230	100	3.3	1.35	11.50	95.5	692.0
11475	100	4.7	1.75	14.55	174.55	1120.7
11476	100	4.7	1.75	14.55	174.55	1120.7
11477	100	4.7	1.75	14.55	174.55	1120.7
11885	100	5.8	2.35	20.14	267.5	1705.0
11886	100	5.8	2.35	20.14	267.5	1705.0
11887	100	5.8	2.35	20.14	267.5	1705.0
11106	100	10.0	3.23	27.69	230.75	2076.4
<hr/>						
12103	250	0.1	1.9	6.4	13.68	123.0
12104	250	0.1	1.9	6.4	13.68	123.0
12105	250	0.1	1.9	6.4	13.68	123.0
12110	250	0.1	1.9	6.4	13.68	123.0
12113	250	0.1	1.9	6.4	13.68	123.0
12203	250	0.25	1.9	6.4	13.68	123.0
12204	250	0.25	1.9	6.4	13.68	123.0
12205	250	0.25	1.9	6.4	13.68	123.0
12330	250	0.33	1.9	6.4	13.68	123.0
12331	250	0.33	1.9	6.4	13.68	123.0
12473	250	0.47	1.9	6.4	13.68	123.0
12474	250	0.47	1.9	6.4	13.68	123.0
12475	250	0.47	1.9	6.4	13.68	123.0
12803	250	0.89	2.22	15.5	16.3	145.1
12804	250	0.89	2.22	15.5	16.3	145.1
12805	250	0.89	2.22	15.5	16.3	145.1
12910	250	1.0	2.3	19.4	15.3	138.1
12911	250	1.0	2.3	19.4	15.3	138.1
12912	250	1.0	2.3	19.4	15.3	138.1
12913	250	1.0	2.3	19.4	15.3	138.1
12914	250	1.0	2.3	19.4	15.3	138.1
12915	250	1.0	2.3	19.4	15.3	138.1
12916	250	1.0	2.3	19.4	15.3	138.1
12917	250	1.0	2.3	19.4	15.3	138.1
12918	250	1.0	2.3	19.4	15.3	138.1
12919	250	1.0	2.3	19.4	15.3	138.1
12920	250	1.0	2.3	19.4	15.3	138.1
12921	250	1.0	2.3	19.4	15.3	138.1
12922	250	1.0	2.3	19.4	15.3	138.1
12923	250	1.0	2.3	19.4	15.3	138.1
12924	250	1.0	2.3	19.4	15.3	138.1
12925	250	1.0	2.3	19.4	15.3	138.1
12926	250	1.0	2.3	19.4	15.3	138.1
12927	250	1.0	2.3	19.4	15.3	138.1
12928	250	1.0	2.3	19.4	15.3	138.1
12929	250	1.0	2.3	19.4	15.3	138.1
12930	250	1.0	2.3	19.4	15.3	138.1
12931	250	1.0	2.3	19.4	15.3	138.1
12932	250	1.0	2.3	19.4	15.3	138.1
12933	250	1.0	2.3	19.4	15.3	138.1
12934	250	1.0	2.3	19.4	15.3	138.1
12935	250	1.0	2.3	19.4	15.3	138.1
12936	250	1.0	2.3	19.4	15.3	138.1
12937	250	1.0	2.3	19.4	15.3	138.1
12938	250	1.0	2.3	19.4	15.3	138.1
12939	250	1.0	2.3	19.4	15.3	138.1
12940	250	1.0	2.3	19.4	15.3	138.1
12941	250	1.0	2.3	19.4	15.3	138.1
12942	250	1.0	2.3	19.4	15.3	138.1
12943	250	1.0	2.3	19.4	15.3	138.1
12944	250	1.0	2.3	19.4	15.3	138.1
12945	250	1.0	2.3	19.4	15.3	138.1
12946	250	1.0	2.3	19.4	15.3	138.1
12947	250	1.0	2.3	19.4	15.3	138.1
12948	250	1.0	2.3	19.4	15.3	138.1
12949	250	1.0	2.3	19.4	15.3	138.1
12950	250	1.0	2.3	19.4	15.3	138.1
12951	250	1.0	2.3	19.4	15.3	138.1
12952	250	1.0	2.3	19.4	15.3	138.1
12953	250	1.0	2.3	19.4	15.3	138.1
12954	250	1.0	2.3	19.4	15.3	138.1
12955	250	1.0	2.3	19.4	15.3	138.1
12956	250	1.0	2.3	19.4	15.3	138.1
12957	250	1.0	2.3	19.4	15.3	138.1
12958	250	1.0	2.3	19.4	15.3	138.1
12959	250	1.0	2.3	19.4	15.3	138.1
12960	250	1.0	2.3	19.4	15.3	138.1
12961	250	1.0	2.3	19.4	15.3	138.1
12962	250	1.0	2.3	19.4	15.3	138.1
12963	250	1.0	2.3	19.4	15.3	138.1
12964	250	1.0	2.3	19.4	15.3	138.1
12965	250	1.0	2.3	19.4	15.3	138.1
12966	250	1.0	2.3	19.4	15.3	138.1
12967	250	1.0	2.3	19.4	15.3	138.1
12968	250	1.0	2.3	19.4	15.3	138.1
12969	250	1.0	2.3	19.4	15.3	138.1
12970	250	1.0	2.3	19.4	15.3	138.1
12971	250	1.0	2.3	19.4	15.3	138.1
12972	250	1.0	2.3	19.4	15.3	138.1
12973	250	1.0	2.3	19.4	15.3	138.1
12974	250	1.0	2.3	19.4	15.3	138.1
12975	250	1.0	2.3	19.4	15.3	138.1
12976	250	1.0	2.3	19.4	15.3	138.1
12977	250	1.0	2.3	19.4	15.3	138.1
12978	250	1.0	2.3	19.4	15.3	138.1
12979	250	1.0	2.3	19.4	15.3	138.1
12980	250	1.0	2.3	19.4	15.3	138.1
12981	250	1.0	2.3	19.4	15.3	138.1
12982	250	1.0	2.3	19.4	15.3	138.1
12983	250	1.0	2.3	19.4	15.3	138.1
12984	250	1.0	2.3	19.4	15.3	138.1
12985	250	1.0	2.3	19.4	15.3	138.1
12986	250	1.0	2.3	19.4	15.3	138.1
12987	250	1.0	2.3	19.4	15.3	138.1
12988	250	1.0	2.3	19.4	15.3	138.1
12989	250	1.0	2.3	19.4	15.3	138.1
12990	250	1.0	2.3	19.4	15.3	138.1
12991	250	1.0	2.3	19.4	15.3	138.1
12992	250	1.0	2.3	19.4	15.3	138.1
12993	250	1.0	2.3	19.4	15.3	138.1
12994	250	1.0	2.3	19.4	15.3	138.1
12995	250	1.0	2.3	19.4	15.3	138.1
12996	250	1.0	2.3	19.4	15.3	138.1
12997	250	1.0	2.3	19.4	15.3	138.1
12998	250	1.0	2.3	19.4	15.3	138.1
12999	250	1.0	2.3	19.4	15.3	138.1

92	2175	2.5	2.88	5.47	48.50	43.85
93	2180	2.5	2.88	5.47	48.50	43.85
94	2185	2.5	1.81	8.64	72.00	64.50
95	2190	2.5	1.81	8.64	72.00	64.50
96	2195	2.5	1.81	8.64	72.00	64.50
97	2200	2.5	1.81	8.64	72.00	64.50
98	2205	2.5	1.81	8.64	72.00	64.50
99	2210	2.5	1.81	8.64	72.00	64.50
00	2215	2.5	1.81	8.64	72.00	64.50
01	2220	2.5	1.81	8.64	72.00	64.50
02	2225	2.5	1.81	8.64	72.00	64.50
03	2230	2.5	1.81	8.64	72.00	64.50
04	2235	2.5	1.81	8.64	72.00	64.50
05	2240	2.5	1.81	8.64	72.00	64.50
06	2245	2.5	1.81	8.64	72.00	64.50
07	2250	2.5	1.81	8.64	72.00	64.50
08	2255	2.5	1.81	8.64	72.00	64.50
09	2260	2.5	1.81	8.64	72.00	64.50
10	2265	2.5	1.81	8.64	72.00	64.50
11	2270	2.5	1.81	8.64	72.00	64.50
12	2275	2.5	1.81	8.64	72.00	64.50
13	2280	2.5	1.81	8.64	72.00	64.50
14	2285	2.5	1.81	8.64	72.00	64.50
15	2290	2.5	1.81	8.64	72.00	64.50
16	2295	2.5	1.81	8.64	72.00	64.50
17	2300	2.5	1.81	8.64	72.00	64.50
18	2305	2.5	1.81	8.64	72.00	64.50
19	2310	2.5	1.81	8.64	72.00	64.50
20	2315	2.5	1.81	8.64	72.00	64.50
21	2320	2.5	1.81	8.64	72.00	64.50
22	2325	2.5	1.81	8.64	72.00	64.50
23	2330	2.5	1.81	8.64	72.00	64.50
24	2335	2.5	1.81	8.64	72.00	64.50
25	2340	2.5	1.81	8.64	72.00	64.50
26	2345	2.5	1.81	8.64	72.00	64.50
27	2350	2.5	1.81	8.64	72.00	64.50
28	2355	2.5	1.81	8.64	72.00	64.50
29	2360	2.5	1.81	8.64	72.00	64.50
30	2365	2.5	1.81	8.64	72.00	64.50
31	2370	2.5	1.81	8.64	72.00	64.50
32	2375	2.5	1.81	8.64	72.00	64.50
33	2380	2.5	1.81	8.64	72.00	64.50
34	2385	2.5	1.81	8.64	72.00	64.50
35	2390	2.5	1.81	8.64	72.00	64.50
36	2395	2.5	1.81	8.64	72.00	64.50
37	2400	2.5	1.81	8.64	72.00	64.50
38	2405	2.5	1.81	8.64	72.00	64.50
39	2410	2.5	1.81	8.64	72.00	64.50
40	2415	2.5	1.81	8.64	72.00	64.50
41	2420	2.5	1.81	8.64	72.00	64.50
42	2425	2.5	1.81	8.64	72.00	64.50
43	2430	2.5	1.81	8.64	72.00	64.50
44	2435	2.5	1.81	8.64	72.00	64.50
45	2440	2.5	1.81	8.64	72.00	64.50
46	2445	2.5	1.81	8.64	72.00	64.50
47	2450	2.5	1.81	8.64	72.00	64.50
48	2455	2.5	1.81	8.64	72.00	64.50
49	2460	2.5	1.81	8.64	72.00	64.50
50	2465	2.5	1.81	8.64	72.00	64.50
51	2470	2.5	1.81	8.64	72.00	64.50
52	2475	2.5	1.81	8.64	72.00	64.50
53	2480	2.5	1.81	8.64	72.00	64.50
54	2485	2.5	1.81	8.64	72.00	64.50
55	2490	2.5	1.81	8.64	72.00	64.50
56	2495	2.5	1.81	8.64	72.00	64.50
57	2500	2.5	1.81	8.64	72.00	64.50
58	2505	2.5	1.81	8.64	72.00	64.50
59	2510	2.5	1.81	8.64	72.00	64.50
60	2515	2.5	1.81	8.64	72.00	64.50
61	2520	2.5	1.81	8.64	72.00	64.50
62	2525	2.5	1.81	8.64	72.00	64.50
63	2530	2.5	1.81	8.64	72.00	64.50
64	2535	2.5	1.81	8.64	72.00	64.50
65	2540	2.5	1.81	8.64	72.00	64.50
66	2545	2.5	1.81	8.64	72.00	64.50
67	2550	2.5	1.81	8.64	72.00	64.50
68	2555	2.5	1.81	8.64	72.00	64.50
69	2560	2.5	1.81	8.64	72.00	64.50
70	2565	2.5	1.81	8.64	72.00	64.50
71	2570	2.5	1.81	8.64	72.00	64.50
72	2575	2.5	1.81	8.64	72.00	64.50
73	2580	2.5	1.81	8.64	72.00	64.50
74	2585	2.5	1.81	8.64	72.00	64.50
75	2590	2.5	1.81	8.64	72.00	64.50
76	2595	2.5	1.81	8.64	72.00	64.50
77	2600	2.5	1.81	8.64	72.00	64.50
78	2605	2.5	1.81	8.64	72.00	64.50
79	2610	2.5	1.81	8.64	72.00	64.50
80	2615	2.5	1.81	8.64	72.00	64.50
81	2620	2.5	1.81	8.64	72.00	64.50
82	2625	2.5	1.81	8.64	72.00	64.50
83	2630	2.5	1.81	8.64	72.00	64.50
84	2635	2.5	1.81	8.64	72.00	64.50
85	2640	2.5	1.81	8.64	72.00	64.50
86	2645	2.5	1.81	8.64	72.00	64.50
87	2650	2.5	1.81	8.64	72.00	64.50
88	2655	2.5	1.81	8.64	72.00	64.50
89	2660	2.5	1.81	8.64	72.00	64.50
90	2665	2.5	1.81	8.64	72.00	64.50
91	2670	2.5	1.81	8.64	72.00	64.50
92	2675	2.5	1.81	8.64	72.00	64.50
93	2680	2.5	1.81	8.64	72.00	64.50
94	2685	2.5	1.81	8.64	72.00	64.50
95	2690	2.5	1.81	8.64	72.00	64.50
96	2695	2.5	1.81	8.64	72.00	64.50
97	2700	2.5	1.81	8.64	72.00	64.50
98	2705	2.5	1.81	8.64	72.00	64.50
99	2710	2.5	1.81	8.64	72.00	64.50

NEW KIT

CAPACITORS

Designed plastic caps with built-in wire leads. Strong and work quickly.



POPULAR VALUES

Part-Kit No.	CAP. VALUE	Voltage	Price
P2000	3.3	315	3.21
P2001	6.8	315	3.21
P2002	10	315	3.21
P2003	22	315	3.21
P2004	47	315	3.21
P2005	100	315	3.21
P2006	220	315	3.21
P2007	470	315	3.21
P2008	1000	315	3.21
P2009	2200	315	3.21
P2010	4700	315	3.21

P0201	1.0	10	38	321	2670	240.30
P0202	0.3	10	38	321	2670	240.30
P0203	3.3	10	38	321	2670	240.30
P0204	1.0	10	38	321	2670	240.30
P0205	0.8	10	38	321	2670	240.30
P0206	6.8	10	52	643	3838	317.87
P0207	1.0	10	38	321	2670	240.30
P0208	1.0	10	78	685	3538	288.40
P0209	0.8	10	78	685	3538	288.40
P0210	6.8	10	78	685	3538	288.40
P0211	3.3	10	134	1143	9571	875.87
P0212	1.0	10	134	1143	9571	875.87
P0213	6.8	10	134	1143	9571	875.87
P0214	0.8	10	134	1143	9571	875.87
P0215	3.3	10	373	3193	26642	2386.33
P0216	1.0	10	373	3193	26642	2386.33
P0217	6.8	10	373	3193	26642	2386.33
P0218	0.8	10	373	3193	26642	2386.33
P0219	3.3	16	47	602	3343	300.20
P0220	1.0	16	47	602	3343	300.20
P0221	6.8	16	47	602	3343	300.20
P0222	0.8	16	47	602	3343	300.20
P0223	3.3	16	55	554	4614	415.24
P0224	1.0	16	55	554	4614	415.24
P0225	6.8	16	55	554	4614	415.24
P0226	0.8	16	55	554	4614	415.24
P0227	1.0	16	106	908	7350	670.00
P0228	0.8	16	106	908	7350	670.00
P0229	6.8	16	106	908	7350	670.00
P0230	1.0	16	106	908	7350	670.00
P0231	3.3	16	189	1618	13485	1232.54
P0232	1.0	16	189	1618	13485	1232.54
P0233	6.8	16	189	1618	13485	1232.54
P0234	0.8	16	189	1618	13485	1232.54
P0235	1.0	25	43	584	3033	277.89
P0236	0.8	25	43	584	3033	277.89
P0237	6.8	25	43	584	3033	277.89
P0238	0.8	25	43	584	3033	277.89
P0239	3.3	25	67	485	4040	368.00
P0240	1.0	25	67	485	4040	368.00
P0241	6.8	25	67	485	4040	368.00
P0242	0.8	25	67	485	4040	368.00
P0243	1.0	25	108	730	5969	544.00
P0244	0.8	25	108	730	5969	544.00
P0245	6.8	25	108	730	5969	544.00
P0246	0.8	25	108	730	5969	544.00
P0247	3.3	25	213	2193	23644	2134.00
P0248	1.0	25	213	2193	23644	2134.00
P0249	6.8	25	213	2193	23644	2134.00
P0250	0.8	25	213	2193	23644	2134.00
P0251	3.3	38	38	321	2670	240.30
P0252	1.0	38	38	321	2670	240.30
P0253	6.8	38	38	321	2670	240.30
P0254	0.8	38	38	321	2670	240.30
P0255	3.3	38	38	321	2670	240.30
P0256	1.0	38	38	321	2670	240.30
P0257	6.8	38	38	321	2670	240.30
P0258	0.8	38	38	321	2670	240.30
P0259	3.3	38	38	321	2670	240.30
P0260	1.0	38	38	321	2670	240.30
P0261	6.8	38	38	321	2670	240.30
P0262	0.8	38	38	321	2670	240.30
P0263	3.3	38	38	321	2670	240

P0156	3.5	35	38	321	2670	2403
P0157	4.7	35	38	321	2670	2403
P0158	0.68	35	38	321	2670	2403
P0159	0.68	35	38	321	2670	2403
P0160	1.5	35	38	321	2670	2403
P0161	1.5	35	38	321	2670	2403
P0162	2.7	35	38	321	2670	2403
P0163	0.68	35	38	321	2670	2403
P0164	0.68	35	38	321	2670	2403
P0165	0.68	35	38	321	2670	2403
P0166	0.68	35	38	321	2670	2403
P0167	0.1	30	4	4	336	95
P0168	0.15	30	4	4	336	95
P0169	0.15	30	4	4	336	95
P0170	0.3	30	4	4	336	95
P0171	0.3	30	4	4	336	95
P0172	0.68	30	4	4	336	95
P0173	0.68	30	4	4	336	95
P0174	0.15	30	4	4	336	95
P0175	0.15	30	4	4	336	95
P0176	3.3	30	4	4	336	95
P0177	3.3	30	4	4	336	95
P0178	3.3	30	4	4	336	95
P0179	3.3	30	4	4	336	95
P0180	3.3	30	4	4	336	95
P0181	3.3	30	4	4	336	95
P0182	3.3	30	4	4	336	95
P0183	3.3	30	4	4	336	95
P0184	3.3	30	4	4	336	95
P0185	3.3	30	4	4	336	95
P0186	3.3	30	4	4	336	95
P0187	3.3	30	4	4	336	95
P0188	3.3	30	4	4	336	95
P0189	3.3	30	4	4	336	95
P0190	3.3	30	4	4	336	95
P0191	3.3	30	4	4	336	95
P0192	3.3	30	4	4	336	95
P0193	3.3	30	4	4	336	95
P0194	3.3	30	4	4	336	95
P0195	3.3	30	4	4	336	95
P0196	3.3	30	4	4	336	95
P0197	3.3	30	4	4	336	95
P0198	3.3	30	4	4	336	95
P0199	3.3	30	4	4	336	95
P0200	3.3	30	4	4	336	95
P0201	3.3	30	4	4	336	95
P0202	3.3	30	4	4	336	95
P0203	3.3	30	4	4	336	95
P0204	3.3	30	4	4	336	95
P0205	3.3	30	4	4	336	95
P0206	3.3	30	4	4	336	95
P0207	3.3	30	4	4	336	95
P0208	3.3	30	4	4	336	95
P0209	3.3	30	4	4	336	95
P0210	3.3	30	4	4	336	95
P0211	3.3	30	4	4	336	95
P0212	3.3	30	4	4	336	95

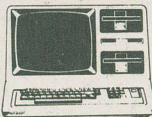
SIZES			Volume Discount
\$2.00	\$5.00	\$9.99	
\$0.75	\$10.00	\$24.99	Less 10
\$0.50	\$25.00	\$49.99	Less 15
\$0.25	\$50.00	\$99.99	Less 20
Over \$1000.00 & Up			Less 25

Prices subject to change without notice.

\$ 10.00-\$25.00	Add \$0.75	\$ 100.00-\$249.99	Less 10%
\$ 25.00-\$49.99	Add \$0.50	\$ 250.00-\$499.99	Less 15%
\$ 50.00-\$99.99	Add \$0.25	\$ 500.00-\$999.99	Less 20%
\$100.00 & Up	Net Charge	\$1000.00 & Up	Less 25%

\$100.00 & Up No Charge \$1000.00 & Up Less 25 %

TRS-80® DISCOUNT



**BUY
DIRECT**

1-800-841-0860 TOLL FREE

**MICRO MANAGEMENT
SYSTEMS INC.**
DEPT. NO. 15

Downtown Plaza Shopping Center
115C Second Ave. S.W.
Cairo, Georgia 31728
912-377-7120 Ga. Phone No.

Write For Free Catalog

EDUCATION & INSTRUCTION

LEARN ham license code in days. Revolutionary course guarantees success even if you failed before! Only \$39.95 to: **CODE QUICK**, Box 3261, Industry, CA 91744, or request details

UNIVERSITY degrees by mail! Bachelors, Masters, Ph.D's... Free revealing details. **COUNSELING**, Box 317-RE12, Tustin, CA 92680

Be an FCC LICENSED Electronic Technician

Earn up to \$600 a Week & More!
No costly school — The Original FCC Tests—Answers exam manual that prepares you at home for FCC General Radiotelephone License. Newly revised multiple-choice exams cover all areas tested on the actual FCC Govt exam! No previous experience required. \$12.95 post-paid. Moneyback Guarantee.
Dept. E P.O. Box 26348, San Francisco, CA 94126



HIGHLY effective short specialized home study courses! Learn highly profitable new skills! Over 50 categories to choose! Advance rapidly! Diploma awarded! Our 36th year! Free literature! **CIEE-12**, Box 20345, Jackson, MS 39209

ATTENTION ELECTRONIC TECHNICIANS



Highly Effective Home Study BSEE Degree Program for Experienced Electronic Technicians. Our New Advanced Placement Program grants Credit for previous Schooling & Professional Experience. Advance Rapidly! Our 36th Year!

FREE DESCRIPTIVE LITERATURE!
Cook's Institute of Electronics Engineering
DESK 15, P.O. BOX 20345, JACKSON, MS 39209

WANTED

AUDIO—Visual Club International. Exchange video or audio cassettes of your collection or have conversation with members of similar interests. For men & women of all ages. Dues \$16/yr. For more info write: **AVCI**, Dept. O, 16 Sycamore St., Chelmsford, MA 01824

ADDRESSERS—mailers—homeworkers needed! 50 firms listed, rush 50 cents, addressed envelope. **BONNIE NIEWIENDAAAL**, P.O. Box 23432, Tampa, FL 33623

HIGHLY PROFITABLE ELECTRONIC FACTORY

Investment unnecessary, knowledge not required, sales handled by professionals. Ideal home business. Write today for facts! **Postcard will do. Barta-RE-T**, Box 248, Walnut Creek, CA 94597.

AMAZING ELECTRONIC PROJECTS and PRODUCTS:

Lasers Super Powered, Burning Cutting, Rifle, Pistol. Pocket. See in Dark—Shotgun Directional Mike—Unscramblers—Giant Tesla—Stunwand—TV Disrupter—Energy Producing, Surveillance, Detection, Electrifying, Ultrasonic, CB, Auto and Mech. Devices, Hundreds More—All New Plus INFO UNLTD PARTS SERVICE. Catalog #1. **Information Unlimited, Dept. R8 Box 716 Amherst, N.H. 03031.**

MAGAZINES

FREE subscriptions to 24 electronics magazines and newspapers. List including instructions on how to qualify, also free. Send \$4.50 for printing and handling to: **EEL**, Box 165A, La Porte, IN 46350

SHORTWAVE RADIO

SONY ICF-2001 digitally synthesized multiband receivers, only \$239.95. Certified check or MO only. Add \$5.00 P&H. **E.D.S., INC.**, Box 70, Lehman, PA 18627

FOR SALE

APPLE Defender for 48K Apple with disk. Fast color hires graphics. All machine language. Specify DOS revision. Use keyboard, paddles, or joystick. Send SASE for info or \$22.00 to: **JOHN ANDERSON**, 895 Georgia Ave., Longwood, FL 32750

PICTURE tube rebuilding equipment—we sell and buy new and used equipment. Free training. **ATOLL TELEVISION**, 6425 Irving Park, Chicago, IL 60634, Phone 312-545-6667

CAPACITANCE meter, 3 1/2 digit, 1 pf to 19,990 µf, \$99.95. Low ohm meter, 3 1/2 digit, 0.01 to 20 ohms, \$99.95. Fully assembled. Moneyback guarantee. **TML ENGINEERING**, 5139 Lapeer Road, Port Huron, MI 48060

THE Intelligence Library. Restricted technical secrets—books on electronic surveillance, lock-picking, demolitions, investigation, etc. Free brochures: **MENTOR**, Dept. Z, 135-53 No. Blvd., Flushing, NY 11354

GAME cassettes: TRS80 color computer 4K—\$6.95 spaceship dock, rubout, racetrack 16K—\$10.95; **THANX PROGRAMS**, 1100 Arbor Town Circle #1218, Arlington, TX 76011

more classified on page 116

SPECIALS

INTERNATIONAL ELECTRONICS UNLIMITED

DEDUCT DISCOUNTS AS NOTED
— in effect through Dec —

SPECIAL 15% OFF ON \$25.00
(total computer components)

CERAMIC DISC CAPACITORS 50V
1pf 47pf 220pf .0047mf
5pf 56pf 270pf .010mf
7pf 68pf 390pf .015mf
10pf 82pf 470pf .022mf
18pf 100pf 600pf .030mf
22pf 120pf .001mf .050mf
27pf 150pf .0015mf .1mf
33pf 180pf .003mf
1pf to .050mf
ea pk-10 pk-100 1000-
\$.20 .95 7.00 .06ea
1mf/50V disc 1/2" d
1.25 1.25 9.50 .09ea

280A CPU 50.95
280A P10 7.95
280A CTC 7.95
280A 510/0 32.45
280A DMA 30.60
280A DART 18.80

2114L 200ms LP \$3.35
4116 200ms 2.95
1702A 25µs 5.05
2708 450ms 5.00
2716 450ms 5V 6.75
8080A 5.25
1602B 5V 12V 4.65

CARBON FILM 25%
1/4watt (R. Ohm R25)
.095" dia x .250" long (body)
1/2watt (R. Ohm R50)
.146" dia x .354" long (body)

CARBON FILM RESISTORS 1/4W & 1/2W
Total qty ea pk-5 pk-10 pk-100
1-999 \$.25 .65 1.10 2.00 7.50
1000- .10 .25 .40 1.90
5000- .10 .20 .40 1.80

METAL FILM 1%
RND (R. Ohm CR60FV) 1/4watt
Low temp coef = 50ppm/°C
1.38" dia x .355" long (body)
color banded

METAL FILM RESISTORS 1/4W
Total qty ea pk-5 pk-10 pk-25 pk-100
1-999 \$.25 .65 1.10 2.00 7.50
1000- .10 .25 .40 1.90 7.00
5000- .25 .55 .95 1.80 6.50

STANDARD 1% METAL FILM VALUES FROM 0 OHM TO 1.21 MOHM

SPECIAL 15% OFF

DIPSWITCHES

45w 8pin SPST \$1.55 \$1.45 \$1.39
85w 16pin SPST 1.95 1.85 1.79
105w 20pin SPST 2.10 2.00 1.95

FECTROLYTIC CAPACITORS

axial leads

1mf/50V .15 .10 .100-
2.2mf/25V .15 .12 .11
2.2mf/50V .15 .12 .11
0.022uf .15 .95 7.50
0.022uf .15 .95 7.50
0.033uf .20 1.00 10.00
0.047uf .20 1.15 10.50
0.068uf .25 1.30 12.00
0.1uf .30 1.75 13.50
0.15uf .35 2.25 14.00
0.22uf .40 2.55 20.00
0.33uf .45 2.75 25.00
0.47uf .50 3.50 30.00

SPECIAL 15% OFF

TANTALUM CAPACITOR KIT

1uf/35V 2.2uf/20V 10uf/25V
3.3uf/35V 3.3uf/35V 47uf/20V
33uf/35V 4.7uf/25V 22uf/35V
1uf/35V 6.8uf/35V 33uf/35V
1.5uf/20V
T-5 Sea of above \$27.50
T-5C Sea supplied in cabinet
(15 drawer) \$37.50
T-10 Sea of above \$49.50
T-10C Sea supplied in cabinet
(15 drawer) \$59.50
T-5C or T-10C shipping \$3.00

ELECTROLYTIC CAPACITOR KIT

AXIAL LEADS

1uf/50V 22uf/50V 220uf/50V
2.2uf/50V 33uf/25V 470uf/35V
3.3uf/50V 47uf/35V 1000uf/35V
4.7uf/50V 100uf/35V 2200uf/40V
10uf/50V 150uf/25V
EA5 Sea of above \$19.50
EA5C Sea supplied in cabinet
(5 drawer) \$29.50
EA10 Sea of above \$27.50
EA10C Sea supplied in cabinet
(15 drawer) \$37.50
EA5C or EA10C shipping \$3.00

SPECIAL 15% OFF

TRANSISTORS

MP5406 10-92 NPN \$.25 .17ea .12ea
2N2222A 10-92 NPN .30 .18ea .15ea
2N2222A 10-18 NPN .45 .35ea .25ea
2N3053 10-92 NPN .55 .50ea .45ea
2N3904 10-92 NPN .25 .17ea .12ea
2N3906 10-92 PNP .25 .17ea .12ea

LEDs

Jumbo diffused .20" d x .34" l
pk-10 pk-25 100- 1000-
RED \$1.00 \$2.25 .08ea .078ea
WHITE 1.10 2.50 .09ea .085ea
YELLOW 1.40 3.25 .11ea .10ea
GREEN 1.40 3.25 .11ea .10ea

TRI-STATE (change from red to green by reversing polarity)

1- 10- 100-
.95ea .75ea .65ea

Subminiature diffused

125" d x .21" l
pk-10 pk-25 100- 1000-
RED \$1.00 \$2.25 .08ea .078ea
CLEAR 1.10 2.50 .09ea .085ea
GREEN 1.40 3.25 .11ea .10ea
YELLOW 1.40 3.25 .11ea .10ea

LED MOUNTING CLIP & RING

For .20" (Jumbo) LED

pk-10 pk-25 pk-100 1000-
\$.125 .275 .70 .06ea

LED DISPLAYS

XAN72 (MAN72 equiv) ea 10-
3" CA RLD LHD .95 .55ea
XAN74 (MAN74 equiv)
3" CA RLD LHD .95 .55ea
XAN620
6" CA RLD LHD 1.25 1.10ea
XAN690
6" CC RLD RHD 1.25 1.10ea

TTL - 7400 10% OFF ON \$25.00
15% OFF ON \$50.00

7400 \$.18 7464 .30 74155 .50
7401 .20 7465 .30 74156 .64
7402 .20 7470 .49 74157 .60
7403 .21 7472 .32 74158 .75
7404 .22 7474 .22 74160 .70
7405 .25 7475 .58 74161 .79
7406 .20 7576 .49 74162 .85
7407 .20 7460 .35 74163 .85
7408 .27 7482 .25 74164 .85
7409 .27 7483 .58 74166 .85
7410 .20 7485 .50 74170 1.50
7415 .29 7486 .42 74173 1.25
7416 .25 7489 1.75 74174 1.05
7417 .20 7490 .59 74175 .85
7420 .20 7491 .64 74176 .70
7425 .39 7492 .59 74177 .70
7426 .35 7493 .35 74180 .35
7427 .25 7494 .59 74181 1.85
7430 .25 7495 .35 74182 .35
7432 .20 7496 .35 74189 .50
7437 .20 74105 .49 74190 1.15
7438 .20 74107 .35 74191 1.15
7440 .27 74121 .35 74192 .50
7441 .59 74122 .39 74193 .79
7442 .35 74123 .39 74194 .85
7443 .55 74125 .50 74195 .69
7444 .60 74126 .50 74196 .80
7445 .50 74132 .75 74197 .75
7446 .59 74141 .35 74198 1.40
7448 .59 74145 .50 74199 1.25
7450 .18 74148 1.25 74200 3.75
7451 .27 74150 1.35 74279 .65
7452 .18 74151 .50
7454 .18 74153 .35
7460 .18 74154 1.45

74LS SERIES 10% OFF ON \$25.00
15% OFF ON \$50.00

74LS00 .25 74LS90 .50 74LS181 2.00
74LS01 .25 74LS107 .40 74LS192 .60
74LS02 .25 74LS107 .40 74LS195 .90
74LS03 .25 74LS109 .40 74LS196 .85
74LS04 .27 74LS112 .40 74LS197 .85
74LS05 .27 74LS113 .40 74LS199 .95
74LS10 .25 74LS114 .50 74LS201 .95
74LS11 .27 74LS125 .50 74LS206 .95
74LS15 .35 74LS126 .50 74LS208 .95
74LS20 .25 74LS136 .50 74LS260 .75
74LS22 .25 74LS166 .95 74LS266 .45
74LS26 .35 74LS162 1.00 74LS290 .75
74LS28 .35 74LS163 .90 74LS298 .85
74LS32 .35 74LS164 .90 74LS365 .85
74LS40 .35 74LS165 .90 74LS367 .70
74LS42 .50 74LS168 1.25 74LS378 1.10
74LS45 .35 74LS170 1.70 74LS490 1.75
74LS74 .45

CMOS - 4000 10% OFF ON \$25.00
15% OFF ON \$50.00

4000 \$.25 4002 1.14 4050 .45
4001 .39 4021 .95 4051 1.15
4002 .25 4022 .95 4056 .79
4006 .95 4023 .30 4069 .39
4007 .39 4024 .75 4071 .29
4008 .95 4025 .95 4085 .30
4009 .46 4027 .59 4073 .39
4010 .45 4028 .85 4078 .39
4011 .45 4030 .49 4081 .39
4012 .25 4035 .95 4083 .30
4013 .59 4040 1.15 4082 .50
4014 .95 4041 1.20 4085 1.50
4015 .95 4042 .95 4901 .59
4016 .64 4043 .85
4017 .08 4046 1.69
4018 .95 4049 .45

LINEAR - 10% OFF ON \$25.00
15% OFF ON \$50.00

CIRCUITS
301N-8 \$.25 741N-8 .32
307N-8 .32 741N-14 .29
309N 1.05 741N-18 .25
311N-8 .29 1301N-14 2.50
318N-1 .45 1414N-14 .35
324N-14 .125 1456N-8 1.29
329N-14 .29 1456N-14 .65
376N-30 .30 1456N-14 .89
380N-14 1.09 1800N-16 2.40
380N-8 .45 2208N-8 .79
386N-8 .45 2208N-8 .79
387N-8 .89 387N-8 .89
555N-8 .45 3081N-16 1.25
556N-14 .79 3082N-16 1.25
560N-16 2.95 3900N-14 .45
560N-14 1.09 75150N-8 .35
567N-8 .49 75450N-8 .35
703N-8 .49 75453N-8 .35
723N-14 .39 75491N-14 .75
734N .45 75492N-14 .89

REGULATORS

7805 +5V \$1.19 7905 -5V \$1.19
7808 +8V \$1.19 7912 +12V \$1.19
7812 +12V \$1.19 7915 +15V \$1.19
7815 +15V \$1.19
7824 +24V \$1.19

INTERNATIONAL ELECTRONICS UNLIMITED

435 First St Suite 19
Solvay, CA 93463
805 686 2747

- Minimum Order \$9.00
- Please include \$1.50 for shipping (UPS)
- We accept VISA and MASTERCHARGE
- EXTRA FAST SERVICE

P.O. BOX 27038, DENVER, COLO. 80227


PHONE ORDERS: 303-781-5750

TEACHERS AND HOBBYISTS

Chaney Electronics has been providing quality electronic kits for high schools, tech schools, universities and hobbyists for over 10 years and we hope you will join the thousands of satisfied Chaney Electronic kit builders. All of our kits contain a quality etched and drilled glass epoxy pc board, all necessary electronic parts (except as noted on a few kits) and easy to understand assembly instructions. You provide a battery for the battery operated kits and if desired you may

wish to provide a case. We recommend that you use a low wattage soldering iron and good quality rosin core solder when assembling your kits. Building our kits is both rewarding and fun because they are thoroughly tested and designed so that with proper assembly they work the first time! If you have any questions please call or write; we are here to assist you.

TIME REACTION TESTER KIT
If you ever thought that your sense of timing was good here's an electronic device to prove it! A LED flashes at a precise interval and you are to push a button at the exact moment it is lit. If your timing is good the led will stay on, if not the LED continues to flash. Size of board: 1" x 2". Operates on 9V battery.
C4516 \$3.50



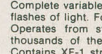
ELECTRONIC "COIN TOSSER" KIT
This kit features an electronic way to "toss a coin". Push the button and a speaker clicks while two readouts flash "0" and "1". Use it to electronically replace the tossing of a coin in games, sporting events, etc. Operates on 9V battery. Size of board: 1 1/2" x 3 1/4".
C4389 \$8.95



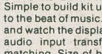
SUPER LED FLASHER KIT
One of our most popular display kits, this unit is perfect for use in robot projects. Simple to build kit features IC circuitry to alternately flash 4 LEDs: 2 red, 1 yellow and 1 green. Produces a bright and colorful display. Operates from 9V battery. Size of board: 2" x 2".
C4407 \$4.98



120VAC VARIABLE STROBE LIGHT KIT
Simple variable rate strobe light kit produces brilliant flashes of light. For parties, dances, display, discos, etc. Operates from standard 120VAC. Reliable design — thousands of these are in use throughout the world. Contains XF-1 straight xenon flashtube. Overall size of completed board: 3"L x 2"W x 3"H.
C3071 \$7.50



SINGLE CHANNEL COLOR ORGAN KIT
Simple to build kit uses SCR to flash a Christmas tree lamp to the beat of music. Connect this up to your stereo or radio and watch the display. Operates from 120VAC and features audio input transformer for isolation and impedance matching. Size of board: 2" x 1".
C4489 \$3.50




GREEN NEON WINKER KIT
This long time favorite now has a new twist. We have designed it with green neons instead of the usual orange glow type. Features 6 green neons that randomly flash. Provides a unique display in the dark. Operates on standard 120VAC. Size of board: 4.8" x 2.8".
C4488 \$4.75




3VDC ELECTRONIC WARNING FLASHER KIT
This portable battery operated device continuously emits bursts of intense light at a fixed repetition rate. Can be seen for great distances making it a great safety device for bicycle riders, skiers, hikers, boaters, campers, etc. Transistorized kit uses high output XF-2 xenon flashtube. Operates on 3VDC (two 1.5V batteries). Size of board: 2 1/2" L x 2" W.
C3207 \$7.95



ELECTRONIC WHEEL OF FORTUNE KIT
Very popular game device! Push the start button and a bright red ball (LEDs) appear to spin around ten numbers gaining speed as you hold the button down. When you release the button the electronic ball appears to slow down and finally comes to a stop on one number. As the ball spins a small speaker emits a ticking sound in synchronization. Unit operates from 9V battery. Size of board: 2 9/16" x 2 6/16".
C3806 \$9.99



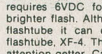
SOUND EFFECTS GENERATOR KIT
Exciting sound effects kit uses the popular T176477 chip to develop phaser, locomotive, siren, tweeting bird, organ, music, etc. sounds. Uses dip switch for simple programming of the generator. A programming chart is included for many different sounds! The kit produces good volume and tone from 2" speaker. Operates from 9V battery. Size of board: 3 3/8" x 2".
C4422 \$12.95



HIGH POWER 120VAC STROBE LIGHT KIT
Variable rate high power strobe light similar to our standard 120VAC kit except produces flashes many times more brilliant. This kit has variable rate control and uses a XF-4 xenon horseshoe flashtube. This kit also includes a reflector for the flashtube. Operates from standard 120VAC. Overall size of board: 4 1/2" L x 3" W.
C4162 \$15.95




6VDC ELECTRONIC STROBE FLASHER KIT
This kit is similar to our 3V Warning Flasher, however it requires 6VDC for operation and produces an even brighter flash. Although supplied with the XF-3 straight flashtube it can even power the optional horseshoe flashtube, XF-4. This unit makes a great safety device or attention getter. Can also be used with optional adapter. Size of circuit board: 3" x 1 1/4".
C3808 \$7.95 AC ADAPTER C3804 \$1.49



PHASOR GUN SOUND AND LIGHT KIT
Here's a simple kit which makes an excellent first project. Uses special IC, darlington transistor and LED to produce "outer space phasor gun" sound and flashing red light. Uses 2" speaker and small size board. Operates from 9V battery. Size of board: 1" x 1 1/2".
C4484 \$4.00



EXECUTIVE DECISION MAKER KIT
Here's another easy to build kit which is fun to use. Each time you need to make an "important" decision just operate the switch and one of two neon lamps will stay on. Features green "yes" lamp and orange "no" lamp. Operates from standard 120VAC. Size of board: 2" x 1".
C4510 \$3.75



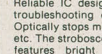
3 CHANNEL COLOR ORGAN
Very popular 3 channel color organ causes lights of your choice to flash to the beat of music. Has 3 different filter stages for low, medium and high notes. Features level control and 3 separate AC outlets to connect Christmas lights, lamps, etc. Operates from 120VAC. Size of board: 3" x 5 1/2".
C4530 \$8.50



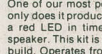
AUDIO OSCILLATOR KIT
Very useful for demonstration or testing speakers, earphones, etc. Kit produces pleasant tone rich in harmonics. Features output transformer for coupling to speaker of your choice. Two transistor circuit is simple to construct. Operates from 9V battery. Requires speaker. Size of board: 2" x 1".
C4511 \$3.00



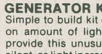
STROBOSCOPE KIT
Reliable IC design kit for use in physics experiments, troubleshooting or demonstrating optical phenomena. Optically stops motion of fans, wheels, pulleys, flywheels, etc. The stroboscope operates from standard 120VAC and features bright xenon flash tube and IC design. Continuously variable flash rate from 100-5000 RPM. Size of board: 3 5/8" x 4 1/8".
C4070 \$29.95




METRONOME WITH SOUND AND LIGHT
One of our most popular kits now has a new feature. Not only does it produce beats in precise time but also it flashes a red LED in time. Features variable control and small speaker. This kit is perfect for music practice and is easy to build. Operates from 9V battery. Size of board: 1" x 2".
C4533 \$3.50



LIGHT SENSITIVE SOUND GENERATOR KIT
Simple to build kit creates a tone which varies depending on amount of light. Uses CDS cell and IC circuitry to provide this unusual effect! In total darkness the unit is silent, as light increases the unit goes from a clicking sound to a loud tone. Uses 2" speaker and operates from 9V battery.
C4164 \$4.95




DIGITAL POWER SUPPLY KIT
Regulated power supply, perfect for TTL or CMOS circuits. Regulated output voltage is 5VDC. Maximum output current is 500 amp. Features fused input, neon indicator light and IC regulator. Kit uses heavy duty transformer for trouble free performance. Operates from standard 120VAC. Size of board: 2" x 4".
C4430 \$6.50



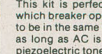
46WS PHOTO STROBE FLASH KIT
Here's your chance to make a quality high power strobe flash for your camera. Can also be used as the master strobe with any of the slave kits. Features quality long life straight flashtube, heavy duty photoflash capacitor, neon ready light, transistorized inverter circuitry and shutter cord for connection to camera. Operates from 4.5VDC to 6VDC. Size of board: 3" x 2 1/2".
C4512 \$9.95



100WS SLAVE STROBE AC KIT
This kit is similar in operation to the DC slave strobe, however, this unit is more than double the light power output. Features heavy duty horseshoe flashtube, two heavy duty photoflash caps, neon ready light, solar cell sensor, and manual test button. Operates from 120VAC. Size of board: 3 1/2" x 4". NOTE: This kit is NOT for beginners since due to the power of the flash, hazardous potentials are present.
C4491 \$34.95



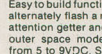
AC TESTER KIT
This kit is perfect for testing AC outlets or determining which breaker operates a particular outlet. There's no need to be in the same room as the unit emits a penetrating tone as long as AC is present. Features green "ON" light and piezoelectric tone alert in a compact unit. Size of board: 2" x 1 1/2".
C4485 \$4.50



DUAL LAMP FLASHER KIT
Ultra miniature lamp flasher kit uses tiny grain of wheat bulbs and IC to flash 2 bulbs at the same time or alternating. Unit produces bright flashes and can be used on model planes, boats, attention getters, warning lights, etc. Operates from 9V battery. Size of board: 1 1/2" x 8".
C4487 \$2.50



LED FLASHER KIT
Easy to build functional kit uses the amazing 555 timer IC to alternately flash a red and green led. The kit makes a great attention getter and can be used in robots, warning lights, outer space models, convention badges, etc. Operates from 5 to 9VDC. Size of board: 1 1/2" x 1 1/4".
C3287 \$2.49




SIGNAL INJECTOR KIT
Signal injectors are useful for troubleshooting all types of radios, amplifiers, tuners, etc. This simple to build transistorized kit produces an output signal rich in harmonics. Every tool kit and test bench should have one of these. Small size allows use of compact cases if desired. Operates from 3VDC. Size of board: 5" x 1 1/2".
C4513 \$3.00



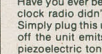
TRI STATE LED FLASHER KIT
Simple to build kit which flashes a tri-state led. The kit has a trimmer control which can be rotated to provide continuous green, alternating red/green, or continuous red. Kit features IC circuitry and jumbo tri-state LED, which, even though it's only a two lead device, can flash red or green. Operates from 9V battery. Size of board: 1 1/4" x 1 1/4".
C4069 \$2.95



46WS SLAVE STROBE DC KIT
Sensitive slave unit flashes in synchronization with your master strobe. Perfect way to obtain more light for portrait pictures. Comparable units sell for many times this low kit price. Features quality long life straight flashtube, neon ready light, solar cell sensor, heavy duty photoflash capacitor and transistorized inverter circuit. Operates from 4.5VDC to 6VDC. Size of board: 3 1/2" x 2 1/2".
C4490 \$18.95



AC FAILURE ALARM KIT
Have you ever been late because the AC went off and your clock radio didn't work, well that need not happen again! Simply plug this unit into the wall outlet and if the AC goes off the unit emits a tone. Features green ready light and piezoelectric tone device. Operates from 9V battery. Size of board: 2 1/2" x 2 3/8".
C4483 \$4.75



FASCINATION STAR KIT
Produces an "Exploding Star" visual effect using 25 LEDs and IC circuitry. The center LED lights first then the next group of LEDs light and then another set lights until the outer edge of the star lights up. The process then reverses itself. Great attention getter for game rooms, discos, etc. Operates from 9V battery.
C4432 \$10.95

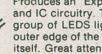



PHOTO SLAVE TRIGGER KIT
Probably the most sensitive slave trigger kit on the market. Not affected by ambient light, this kit is designed for LASER types. This kit can operate from bounce or indirect flash. Simply connect shutter cord (included) to the strobe that will be used as the slave. When the master strobe is fired the slave strobe will also flash. Size of board: 1 1/2" x 1".
C4450 \$6.00



10 WATT SIREN KIT
This kit is perfect for use in burglar alarms, panic buttons, attention getters, etc. Kit provides a loud alternating tone output. Uses two IC's and a power transistor to provide reliable performance. Features variable sound control and 6 to 12VDC operation. Requires 8 ohm speaker. Size of board: 3 1/2" x 1 1/2".
C4068 \$5.00



SEQUENTIAL LED FLASHER KIT
This kit combines CMOS IC circuitry and 10 jumbo red LEDs to produce a unique visual display. LEDs continuously light sequentially from right to left. Easy to build kit makes a great conversation piece and attention getter. Operates from 9V battery. Size of board: 5 1/2" x 1 1/2".
C4431 \$6.75



**NEW KITS FROM
CHANEY ELECTRONICS**

CPU'S & SUPPORT CHIPS

8080A	3.75	8226	2.75
8085A	7.50	8251	5.50
AMD 2901	8.95	8255	6.95
8212	2.25	8258 (17)	6.95
8214	3.50	280A CPU	6.75
8215	2.90	280A CPU	12.95
8224	3.25	280A SIO	16.95
MM5307	9.95	8275	

RAM's

2114-3	2.75	2708	3.95
2116-3	2.50	2716 + 5V	7.50
4116-2	3.50	2732	16.95
2102-4	3.50	2532	16.95
2102-4	3.50	8253-2	1.95
MM4022-3	3.50	825112	4.95
MM4026-11	2.95	825113	1.95
TM5404S-25	4.50	825123	2.25
MS4006-1	2.45	825126	1.95
2101-1	2.45	825129	1.95
MM5270	3.45	825130	1.95
MM4008P	1.95	825131	2.25
IM701	4.95	825181	6.95
5101E	2.95	3608A-3	6.95
211AL	2.45	AM5218C	2.95
		8256-5 (74188A)	1.25

ROM's

AY5-1013	3.75	MM88A	8.95
TR1602B	3.95	COM2017	3.75
PT1482B	3.25	AY3-8500-1	1.95
		AY3-8700	2.25

14 PIN HEADERS	3/61.00
16 PIN HEADERS	40
24 PIN HEADERS	75
40 PIN HEADERS	1.10
50 PIN EDGEBOARD CONN.	95
26 PIN EDGEBOARD CONN.	2.50
50 PIN RIGHT ANGLE CONN.	3.95
20 PIN RIGHT ANGLE CONN.	2.25

50 PIN RIBBON CONNECTORS	\$3.25
40 PIN RIBBON CABLE CONN.	\$2.75
20 PIN RIBBON CABLE CONN.	\$2.25
10 PIN RIBBON CABLE CONN.	\$1.50

4" x 6" DOUBLE SIDED EPOXY BOARD % THICK	5/62.60
5/62.60	

1/16" thick with 1/10" spacing	
4 1/2" x 6 1/2" \$1.95	

DATL'S DAC-08EQ	
8 bit DAC - \$7.95	
INTERDIGITAL ANALOG SWITCH	
2 CHANNEL DRIVERS	\$11.50
INTERDIGITAL 7412-12 BIT	
A/D CONVERTER	\$26.50
REDICION SAD 1024 ANALOG DELAY LINE	\$10.95

74500	30	74574	70	745158	1.25
74502	30	74588	90	745169	1.75
74503	30	74589	130	745170	1.75
74504	30	74512	35	745174	1.40
74506	45	745133	140	745175	1.40
74508	45	745134	140	745176	1.40
74510	45	745138	125	745257	1.50
74511	45	745139	110	745258	1.40
74515	40	745140	110	745260	1.40
74520	40	745153	110	745280	1.50
74530	40	745151	110	745373	2.25
74532	40	745157	125		

7 WATT LD 65 LASER	
DIODE IR \$8.95	

25 watt Infra Red Pulse (SG 2006 equiv.)	
Laser Diode (Spec sheet included) \$24.95	

2N3820 P FET	\$.45
2N5457 N FET	\$.45
2N6446 UJT	\$.45
ER 900 TRIGGER DIODES	4/81.00
2N 6028 PROG. UJT	\$.65

DISC CAPACITORS	
1UF 35V	10/01.00
01UF 35V	16/01.00
10UF 35V	100/8.00
100UF 35V	100/85.00

IN4148 (IN914)	15/1.00
----------------	---------

TANTALUM CAPACITORS	
47UF 35V	5/1.00
68UF 35V	5/1.00
10UF 35V	5/1.00
2.2UF 20V	5/1.00
3.3UF 20V	4/1.00
4.7UF 35V	4/1.00
120UF 6V	\$.85
200UF 20V	\$1.75

SANKEN	
AUDIO POWER AMPS	
Si 1010 G 10 WATTS	\$ 7.50
Si 1020 G 20 WATTS	\$12.50
Si 1050 G 50 WATTS	\$27.50
200 PRV 1A LASCR	.95

RS232	
CONNECTORS	
DB 25P male	\$2.75
DB 25S female	3.75
HOODS	1.25

POSTAGE	ADD 10% FOR ORDERS UNDER \$20.00
RATES	ADD 5% FOR ORDERS BETWEEN \$20.00 AND \$50.00
	ADD 3% FOR ORDERS ABOVE \$50.00

CLOCK CHIPS	
MM5314	\$4.75
MM5316	\$4.95
MM5387AA	\$5.95

5V at 800ma SOLAR CELLS	
3" diameter	\$4.35

7 SEGMENT DISPLAYS	
FSC8024 4 digit	DL-707 C.A. 3" \$.75
C.C. 8" display	\$5.95
FND C30 C.C. 5"	\$.85
FND810 8" C.C.	\$1.95
FND510 C.A. 5"	\$.85
FND803 C.C. 8"	\$1.95
DL-704 3" C.C. 8"	\$.85
MAN 5 C.C. Green	\$.75
MAN 82 C.A. Yellow	\$.75

TERMS: FOB CAMBRIDGE, MASS. SEND CHECK	
OR MONEY ORDER. MINIMUM TELEPHONE	
C.O.D. PURCHASE ORDER OR CHARGE \$20.00	
MINIMUM MAIL ORDER \$5.00	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

C/MOS

4001	20	4002	40	4081	20	74C74	50
4002	20	4003	55	4082	20	74C76	70
4006	65	4009	75	4093	60	74C83	130
4008	65	4014	225	4098	175	74C86	140
4009	45	4035	75	4510	65	74C86	50
4010	45	4040	65	4511	65	74C90	90
4011	20	4042	55	4514	140	74C151	175
4012	20	4043	65	4515	150	74C157	175
4013	30	4044	55	4516	75	74C160	120
4014	55	4049	90	4520	70	74C163	115
4015	55	4047	90	4521	70	74C165	125
4016	30	4048	40	74C02	27	74C173	130
4017	30	4050	40	74C02	27	74C174	130
4018	50	4051	80	74C02	27	74C174	130
4019	45	4052	80	74C02	27	74C174	130
4020	70	4053	75	74C10	27	74C191	175
4021	55	4056	50	74C10	27	74C191	175
4022	80	4058	20	74C32	45	74C326	550
4023	20	4071	25	74C32	45	74C326	550
4024	45	4072	20	74C73	75		
4025	25	4076	40				
		4077	35				

SPECIALS

2114L-4	\$ 1.75
8264-2 + 5V 64K RAM	14.50
8X300 - SIGNETICS 16 BIT	
MICROCONTROLLER	89.00
4 ea. 2716 (+5V)	22.00
8 ea. 4116-3 RAM's	16.75
10 ea. 8164E 64K RAM (150NS)	99.50
L14H4 IR + VISIBLE DETECTOR 3/1.00	
MM5307 - Baud Rate Generator	\$9.95

RS 232 CABLE

10 Conductor, # 22 color coded wire,	
gray PVC outer cover, 3/4" diameter	
40 per ft. - 100' / \$30.00	
Add 20% postage for orders under 100'	
Add 10% postage for orders under 100'	

SPECIALS GOOD THRU DEC. 1981

CRYSTALS \$3.45 ea.	
2,000 MHz	6.144 MHz
3,000 MHz	10,000 MHz
3.57 MHz	18,000 MHz
4,000 MHz	8,000MHz
5,000 MHz	18,432 MHz
6,000 MHz	20,000 MHz

DIP SWITCHES	
CTS 206-4	4 POSITION 1.25
CTS 206-8	8 POSITION 1.50
CTS 206-10	10 POSITION 1.95

MINIATURE MULTI-TURN TRIM POTS	
50, 100, 500, 1K, 5K, 10K, 50K, 250K	\$.75 each 3/62.00

NO. 30 WIRE WRAP WIRE SINGLE STRAND	
100'	\$1.40

40 CONDUCTOR 3M CABLE	
#28 WIRE	\$.75/FT

100	\$1.40
40 CONDUCTOR 3M CABLE.		
#28 WIRE		\$.75/FT

#28 WIRE	\$.75/FT
----------	-------	-----------

FP 100 PHOTO TRANS	\$.50
RED, YELLOW, GREEN OR AMBER LARGE LED'S 2"	6/61.00
RED GREEN BIPOLAR LED'S	\$.55
MLED92 IR LED	\$.75
MD148 LED PHOTO DARL. XTOR	\$.50
TIL 190PTO ISOLATOR	\$.60
IL-5 OPTO ISOLATOR	\$.45
1 WATT ZENERS: 3.3, 4.7, 5.1, 5.6, 6.8, 8.2, 9.1, 10,	
12, 15, 18, or 22V	6/61.00

SFC 3301 - 50 PRV 30A	
FAST RECOVERY DIODE (35ns)	\$2.25
20KV 250MA DIODE	\$1.90

400	1.20	1.40	2.60	12.00	400	1.30	1.90	3.10
600		1.80	3.60	15.00	600	2.00	2.75	4.30

CLOCK CHIPS	
MM5314	\$4.75
MM5316	\$4.95
MM5387AA	\$5.95

5V at 800ma SOLAR CELLS	
3" diameter	\$4.35

7 SEGMENT DISPLAYS	
FSC8024 4 digit	DL-707 C.A. 3" \$.75
C.C. 8" display	\$5.95
FND C30 C.C. 5"	\$.85
FND810 8" C.C.	\$1.95
FND510 C.A. 5"	\$.85
FND803 C.C. 8"	\$1.95
DL-704 3" C.C. 8"	\$.85
MAN 5 C.C. Green	\$.75
MAN 82 C.A. Yellow	\$.75

TERMS: FOB CAMBRIDGE, MASS. SEND CHECK	
OR MONEY ORDER. MINIMUM TELEPHONE	
C.O.D. PURCHASE ORDER OR CHARGE \$20.00	
MINIMUM MAIL ORDER \$5.00	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
FEATURING TRANSISTORS &	
RECTIFIERS, 145 HAMPSHIRE	
ST. CAMBRIDGE, MASS. 02139	

SEND \$2.50 FOR OUR CATALOG	
-----------------------------	--

OUTDOOR AUTOMATIC LIGHTING WITH PASSIVE INFRARED

SECURITY LIGHT CONTROL



Amazing infrared device detects and foils intruders, welcomes guests, prevents accidents and saves energy!

Your family is sound asleep. An intruder is stealthily approaching your darkened house. But when he enters the detection pattern, the SLC senses his body heat and ZAP! Your outside lights come on instantly, destroying his cover of darkness before he ever gets to your door. A crime is prevented. And when you finally arrive home that same SLC automatically turns on your driveway and porch lights for a safe, warm welcome.

HOW IT WORKS

This exciting new product incorporates the latest advances in heat-sensing infrared technology. Manufactured by Colorado Electro-Optics, the leading producer of infrared security devices in the US, the SLC detects the heat energy of any person or vehicle that enters its invisible detection pattern. It will then automatically turn on up to 500 watts of outside lighting. These lights will remain on until four minutes after the last person leaves the detection area. No timers, no switches, no all-night flood lights.

SLC NEVER FORGETS

Unlike timers that respond only to

preset programs, the SLC reacts to the presence of human beings. It is now possible to have your lights on when and only when you really need them, all automatically. In addition to a reliable security device, the SLC can provide your family with increased safety, convenience and home energy savings. No more stumbling over unseen objects, tripping on dark stairs, or fumbling with your keys. No more wasted energy from forgetting to turn off the lights. And your guests will appreciate the automatic welcome your home always provides.

SAFE, EASY TO INSTALL

The SLC does not emit energy of any kind and is totally harmless to living things. Rugged, weather resistant, UL listed and good looking, a low-cost SLC should be put near every entryway. The sensor is adjustable to cover an area 35 feet by 25 feet. Installing the SLC is as simple as wiring a switch, an easy job for the do-it-yourselfer.

Your home is an important investment, and your family is irreplaceable. They deserve the sophisticated protection of the Security Light Control.

SLC ORDER FORM

If not completely satisfied I may return the SLC within 60 days of purchase for a full refund. The unit carries a limited one year warranty.

Please Print

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

Please send me _____ Security Light Control(s) at \$199 each, totalling \$ _____

For my convenience, Colorado Electro-Optics will pay surface shipping charges.

Enclosed is my ☐ Money Order
☐ MasterCard or ☐ Visa

ACCOUNT NO _____

EXPIRATION DATE _____

☐ Personal Check
☐ Ship COD to above address
(10% deposit enclosed)

☐ Please send more information.

SIGNATURE _____

Colorado Electro-Optics, inc.
2200 Central Ave., Dept. R
Boulder, Colorado 80301
(303) 494-3200



A DIVISION OF LINEAR CORP.

Colorado Electro-Optics, inc.

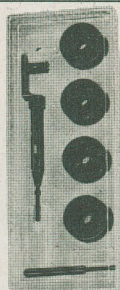
CIRCLE 18 ON FREE INFORMATION CARD

DECEMBER 1981

TOLL FREE ORDERING NUMBER 1-(800) 423-7144



PRODUCTS

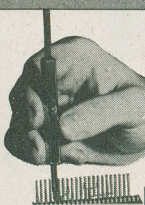


JUST WRAP KIT

Just Wrap tool for daisy chain wiring. Tool strips as it wraps and cuts. Includes one 50 foot spool of wire.

Part No.	Description	Price
JW-1*	Just Wrap Tool	\$14.95
JWK-6	Tool w/4 Spools and JUW1	24.95
R-JW*	50 Ft. Replacement Wire	3.49
JUW-1	Unwrapping Tool	3.49

*Specify Color: Red, Blue, White or Yellow.



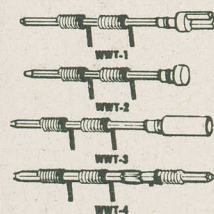
Regular Wrap



Modified Wrap

HAND WRAP TOOL

Part No.	Description	Price
WSU30	Regular	\$6.95
WSU30M	Modified	7.95

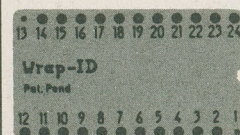


TERMINALS

- .025 (0.63mm) Square Post
- 3 Level Wire-Wrapping
- Gold Plated 25 PER PKG.

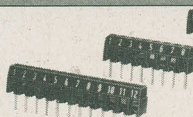
Part No.	Description	Price
WWT-1	Slotted Terminal	\$4.98
WWT-2	Single Sided Terminal	2.98
WWT-3	IC Socket Term.	4.98
WWT-4	Double Sided Terminal	1.98
INS 1	Insertion Tool for above	2.49

SOCKET WRAP - ID



Slipped onto socket before wrapping to identify pins.

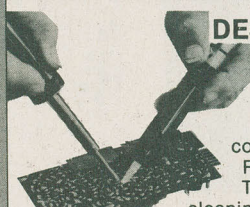
Part #	Price	Bulk Price	Part #	Price	Bulk Price
14ID	1.49/10	5.50/100	22ID	1.49/5	5.95/50
16ID	1.49/10	5.95/100	24ID	1.49/5	5.95/50
18ID	1.49/10	5.00/50	28ID	1.49/5	6.50/50
20ID	1.49/5	5.00/50	40ID	1.49/5	5.00/25



P.C.B. TERMINAL STRIPS

The TS strips provide positive screw activated clamping action, accommodate wire sizes 14-30 AWG (1.8-0, 25mm). Pins are solder plated copper, .042 inch (1mm) diameter, on .200 inch (5mm) centers.

Part No.	Description	Price
TS- 4	4-Pole	\$1.69
TS- 8	8-Pole	2.59
TS-12	12-Pole	3.49
TS6MD	2-Pole Interlocking	3/1.79



DESOLDERING PUMP

Easy one hand operation. Rugged all metal construction. Replaceable TEFLON® Tip. Self cleaning on each stroke. Suction precisely regulated for reliable desoldering without damage to delicate circuitry.

DSPI	Desoldering Pump	\$9.95
------	------------------	--------

LOGIC PROBE



Compatible with all logic families using a 4 to 15V power supply. Thresholds automatically programmed. Visual indication of logic levels to show high, low, bad level or open circuit logic pulses.

- 10 N sec. pulse responses
- 120 K input impedance.
- Automatic resetting memory.
- Includes tip with protective cap & coiled cord.

PRB-1	\$36.95
-------	---------

LOGIC PULSER

Superimposes a pulse train (20 pps) or a single pulse onto the circuit node under test without un-soldering IC's.

- Automatic polarity sensing
- 2 us pulse width
- Finger tip push button actuated
- Includes tip with protective cap & coiled cord.

PSL-1	\$48.95
-------	---------

VACUUM VISE

Unique vacuum-based light duty vise for precision handling of small components and assemblies. Rugged ABS construction. 1 1/2" (32mm) travel for maximum versatility. Also features screw lugs for permanent installation.



VV1	Vacuum Vise	\$3.49
-----	-------------	--------



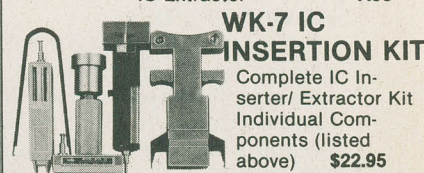
HOBBY-WRAP TOOL BW2630

- Auto-Indexing
- Anti-Overwrap
- Modified Wrap

Part No.	Description	Price
BW2630	Tool	\$19.85
BT30	#30 Bit (not incl.)	3.95
BT2628	#28 Bit (not incl.)	7.95
BC1	Batteries & Charger	14.95

INSERTION/EXTRACTION TOOLS

Part No.	Description	Price
INS1416	14-16 pin Insertor	\$3.49
MOS1416	14-16 pin MOS Safe Insertor	7.95
MOS2428	24-28 pin MOS Safe Insertor	7.95
MOS40	40 pin MOS Safe Insertor	7.95
EX1	14-16 pin IC Extractor	1.49
EX2	24-40 pin IC Extractor	7.95



WK-7 IC INSERTION KIT

Complete IC Insertor/ Extractor Kit Individual Components (listed above) \$22.95

IC DISPENSER

Allows IC's to be dispensed from their tube 1 at a time and picked up by insertion tools above.

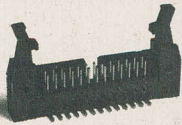
- Dispenses 8-42 pin IC's
- Compatible with all IC carrying tubes
- Use with WK7 for MOS safe insertion.

Part No.	Description	Price
MDD1	1 Chan. Dispenser	\$21.85
MDD5	5 Chan. Dispenser	83.43
MDD10	10 Chan. Dispenser	160.45

* * *No Discount.

CIRCLE 11 ON FREE INFORMATION CARD

IDC CONNECTORS

RIGHT ANGLE HEADERS
SOLDER TAIL WIRE WRAP

Size	Part No.	Price	Part No.	Price
10	IDH10SRB	\$1.20	IDH10WRB	\$2.60
20	IDH20SRB	1.90	IDH20WRB	4.15
26	IDH26SRB	2.75	IDH26WRB	5.35
34	IDH34SRB	3.75	IDH34WRB	6.25
40	IDH40SRB	3.75	IDH40WRB	7.35
50	IDH50SRB	4.75	IDH50WRB	9.20

.1" Spacing. Mounts on PC Board & Mates with IDS Socket below. Ejector Bars - 4/1.00.

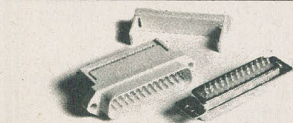
EDGE CARD CONNECTORS

Size	Part No.	Price
10	IDE10B	\$3.95
20	IDE20B	4.35
26	IDE26B	5.00
34	IDE34B	6.05
40	IDE40B	6.90
50	IDE50B	7.50

.1" Spacing. Crimps onto cable with ordinary vise & mates with standard .062" Card Edge.

RIBBON CABLE

Size	Solid Color		Color Coded	
	10 ft.	100 ft.	10 ft.	100 ft.
10	2.90	17.00	4.00	30.00
14	3.40	23.80	5.00	42.00
16	3.70	27.20	5.60	48.00
20	4.40	34.00	7.00	60.00
24	5.00	40.80	8.00	72.00
26	5.40	44.20	8.60	78.00
34	6.80	57.80	11.00	102.00
40	7.80	68.00	13.00	120.00
50	9.50	85.00	16.00	150.00



25 PIN "D" CONNECTORS

Solder Style	Part No.	Price
Male	DB25P	\$2.95
Female	DB25S	3.95
Cover	DB25C	1.50

IDC Style	Part No.	Price
Male	IDB25P	6.25
Female	IDB25S	6.60
Cover	IDB25C	1.60

Solder Style solders onto cable, IDC Style crimps onto cable with vise. 9, 15, 37 and 50 pin available also.

CABLE PLUGS

Size	Part No.	Price
14	IDP14B	\$1.45
16	IDP16B	1.65
24	IDP24B	2.50
40	IDP40B	4.15

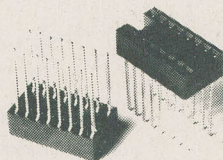
.1" Spacing. Crimps onto cable with ordinary vise & plugs into standard IC Socket.

SOCKETS

Size	Part No.	Price
10	IDS10B	\$1.88
20	IDS20B	2.75
26	IDS26B	3.50
34	IDS34B	4.50
40	IDS40B	5.40
50	IDS50B	6.50

.1" Spacing. Crimps onto cable with ordinary vise & mounts to header sold above.

WIRE WRAP SUPPLIES



Size	Part No.	Each	Tube
08	ICN083WBSG	.44	52x .39 = \$20.28
14	ICN143WBSG	.53	30x .46 = \$13.80
16	ICN163WBSG	.58	26x .50 = \$13.00
18	ICN183WBSG	.78	23x .68 = \$15.64
20	ICN203WBSG	1.00	21x .85 = \$17.85
22	ICN224WBSG	1.07	19x .92 = \$17.48
24	ICN246WBSG	1.09	17x1.09 = \$15.98
28	ICN286WBSG	1.43	15x1.23 = \$18.45
40	ICN406WBSG	1.85	10x1.60 = \$16.00

Selective Plating provides gold in contact where it counts. 3-level wrap. Save by buying sockets by the tube. All gold available at 1/2¢/pin extra charge.

* * * No Discount

WIRE KITS

Kit No. 1 - \$9.95

250	3"	100	4 1/2"
200	3 1/2"	100	5"
100	4"	100	6"

Kit No. 2 - \$24.95

250	2 1/2"	250	5"
500	3"	100	5 1/2"
500	3 1/2"	100	6"
500	4"	100	6 1/2"
250	4 1/2"	100	7"

Kit No. 3 - \$34.95

250	2 1/2"	500	4 1/2"
500	3"	500	5"
500	3 1/2"	500	5 1/2"
500	4"	500	6"

Kit No. 4 - \$59.95

500	2 1/2"	1000	4 1/2"
1000	3"	1000	5"
1000	3 1/2"	1000	5 1/2"
1000	4"	1000	6"

ORDERING INFORMATION

Prepaid orders over \$50 shipped prepaid via UPS. All others add \$3.00 for handling. VISA, MC, COD's and open account orders will be charged freight. \$15 minimum order. \$100 minimum open account order.

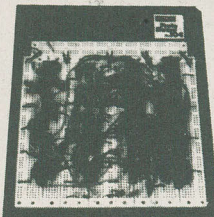
DISCOUNT SCHEDULE

Order	Amount
\$15 - 99	Net
100 - 199	less 10%
200 - 499	less 15%
500 - 999	less 20%
1000 up	less 25%

Discount and the name of this magazine must be mentioned at time of order to get discount. Discount applies on all items except as noted, "No Discount."

CIRCLE 11 ON FREE INFORMATION CARD

PRIORITY ONE ELECTRONICS



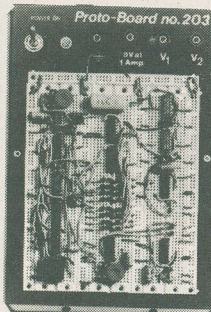
PROTO-BOARD UNITS

All the speed and convenience of QT sockets and Bus Strips plus backplanes and binding posts in both kits and pre-assembled units. Assemble, test and modify circuits as fast as you can think.

Part No.	Dip Capacity	Board Size Inches	Price
GSCPB86	Kit	10(14's)	6x4x1/4 \$19.95
GSCPB100	Kit	10(14's)	4 1/2x6x1/4 \$21.95
GSCPB101	ASM	10(14's)	6x4 1/2x1/4 \$28.95
GSCPB102	ASM	12(14's)	7 1/4x4 1/2x1/4 \$34.95
GSCPB103	ASM	24(14's)	9x6x1/4 \$59.95
GSCPB104	ASM	32(14's)	9 1/2x8x1/4 \$77.00

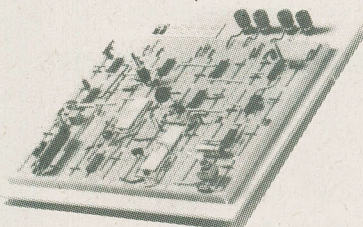
PROTO-BOARD PB-203 - HOLDS 24 14-PIN IC'S

Fully assembled breadboard contains built-in, short-proof, fused, 5VDC at 1 amp, regulated power supply, in addition to three QT-59S sockets, four QT-59B bus strips, one QT-47B bus strip and four binding posts. Capacity for most digital and many analog projects. **SIZE:** 9.75" LG, 6.6" W, 3.25" H. **WEIGHT:** 5 lbs.



GSCPB203	List Price	\$133.00
	Our Price	\$125.00
GSCPB203A	All features plus $\pm 15VDC$ @ 500mA	\$174.00
	Our Price	\$160.00
GSCPB203AK	Kit version of the 203A	\$149.95
	Our Price	\$138.00

ALL-CIRCUIT EVALUATORS



- ACE for fast, solderless, plug in circuit building and testing. Plug in any components with leads up to 0.032" diameter. Interconnect with solid wire up to 20 gauge. Gold-anodized aluminum base/ground. Non corrosive nickel silver terminals. 4 rubber feet.

PART NO.	ACE MODEL NO.	DIP CAPACITY	TIE POINTS	NO. BUSES	NO. POSTS	PRICE EACH
923333	200-K (kit)	8	728	2	2	\$22.75
923332	208 (assem)	8	872	8	2	\$30.70
923334	201-K (kit)	12	1032	2	2	\$29.95
923331	212 (assem)	12	1224	8	2	\$37.05
923326	218 (assem)	18	1760	10	2	\$49.80
923325	227 (assem)	27	2712	28	4	\$63.55
923324	236 (assem)	36	3648	36	4	\$84.75

Hot Vac® Desoldering Ungar Systems

HOT VAC Model 2000A is the economical, no-compromise, non-magnetic desoldering system designed for use with shop air.

- A solid-state control adjusts tip temperatures from 500° to 1000°F.
- The load modulated heater assures instantaneous recovery.
- Transient spikes are fully suppressed.
- The continuous, high flow vacuum is actuated by a switch conveniently built into the handle.
- Biomechanically designed handle reduces fatigue and increases productivity.



FREE!

	LIST PRICE	OUR PRICE
UNG44	\$399.00	\$375.00
Includes UNG6966 Heat Gun (\$65.00) Included FREE!		

ZENITH LIST PRICE \$159.00



OUR PRICE \$139.00

The new Zenith ZVM-121 features a P31 green phosphor tube along with 15 MHz bandwidth. Switch selectable for 40/80 characters/screen. Fully compatible with 80 column Apple cards. 20 lbs.



STAR MODEM FROM PRENTICE

LIST PRICE \$199.00

OUR PRICE \$149.00

0 to 300 baudrate rate. Compatible with Bell 103 and 113. Answer/Originate. Full/Half Duplex. Special self test features.

PRN-STAR

RS232, DB25P, EIA

CND-RS2328F Class I Cable 8 con. 8 ft. \$19.95

PANA VISE

LOW-PROFILE BASE \$13.95 PNV-305

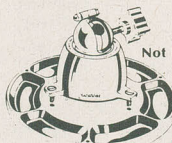
SH. WT. 2lbs



SH. WT. 2 lbs.

VACUUM BASE \$21.95 PNV-380

PNV-304 \$18.45



Not Included

\$13.95

PNV-312 TRAY BASEMOUNT

PNV-371 SOLDER & IRON HOLDER 8 oz. \$5.95



HORIZONTAL JAW VISE HEAD

STANDARD VISE HEAD \$16.95 PNV-303



SH. WT. 2lbs

PNV-333 \$39.95

SH. WT. 8 lbs

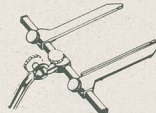
RAPID ASSEMBLY

CIRCUIT BOARD HOLDER

STANDARD BASE PNV-300

SH. WT. 2 lbs

\$13.95



PNV-315 \$19.95

SH. WT. 1lb.

P.C. BOARD HOLDER with 14" bar FITS S-100 BOARDS



DUAL 90 CORNER CLAMPS PNV-390 \$6.95 (pair) 8 oz

SELF CENTERING 9" WIDE OPENING VISE HEAD \$20.95

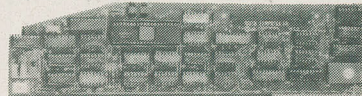


PNV-376

PANA VISE TILTS, TURNS, AND ROTATES TO ANY POSITION. IT HOLDS YOUR WORK EXACTLY WHERE YOU WANT IT.



Vista APPLE DOUBLE DENSITY 8" DISK CONTROLLER

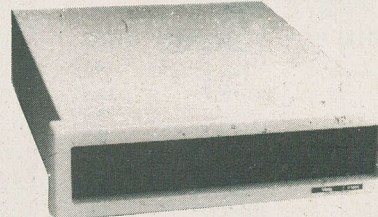


Vista introduces high-speed, DMA data transfer, and high-capacity IBM compatible single and double-density data storage to the Apple II® computer with the A800 Eight-Inch Floppy Disk Controller.

- High Speed DMA Transfer of Data (1 Microsecond/Byte).
- Complete Documentation Provided—Includes Theory of Operation, Source Code for DOS Enhancement Utilities, Schematics and Diskette.
- Uses All Standard Apple DOS Commands (OPEN, CATALOG, LOCK, DELETE, LOAD, etc.) Except for INIT Which Has Been Improved and Enhanced in a Vista Format Routine.
- Compatible With Apple DOS 3.2/3.3, Pascal 1.1 and CPM 2.2 (With the Z80 Soft Card by Microsoft)
- Interfaces to All Shugart/ANSI Standard Eight-Inch Floppy Disk Drives.
- 2Kx8 PROM Contains Autoboot Functions and All Eight-Inch Floppy Driver Code Allowing Complete Memory UsageMap Compatibility with Apple DOS 3.2/3.3
- 120 Days Parts and Labor Warranty.

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
VISA800	Controller and disk	\$595.00	\$559.00
VISA800	When purchased simultaneously with one of the "PDB" Vista and TEI disk specials below		\$525.00

VISTA DUAL 8" DISK CABINET



- Features modular construction with removable sub-assembly that allows easy cabinet positioning and mounting.
- Drives pull out for easy service and maintenance.
- Deluxe chassis with internal slide allows easy access for drive positioning and mounting.
- Built to mechanically and electrically accommodate single sided drives, double sided drives—including the most popular 8-inch Winchester and Shugart floppy disk drives, and 8-inch streaming tape cartridge units.
- Industrial quality cabinet with die cast front bezel.
- Meets all UL and OSHA standards.
- Additional Savings! Front and rear retma rail mounts provided at no extra charge (no external slides)
- Desk or rack mountable
- Internal power and data cables.

	List Price	OUR PRICE
VISV100 Disk Drive Cabinet	\$495.00	\$449.00
Shipping Weight: 35 lbs.		

BUY THE CABINET AND SHUGART 801rs OR QUME DT-8s AND SAVE

	with ONE drive	
PDBV100S1	With Shugart 801R	\$ 900.00
PDBV100Q1	With Qume DT-8	\$1045.00
	with TWO drives	
PDBV100S2	With Shugart 801R	\$1300.00
PDBV100Q2	With Qume DT-8	\$1600.00

Due to UPS shipping regulations, disk drives will be shipped separately from the cabinet. Don't forget to include shipping for each drive. 16 lbs. ea.

PRIS05KSK External data Cable \$19.95

SPECIAL PURCHASE GOLD 16 PIN LOW PROFILE IC. C95 SOOKETS



TIG-16LP pkg of 100	\$16.00
TIG-16LP pkg. of 1000	\$120.00
OEMS Stock up at this LOW PRICE	

PRIORITY ONE ELECTRONICS

9161 DEERING AVE., CHATSWORTH, CA91311

ORDER TOLL FREE (800) 4235922 CA, AK, HI CALL (213) 709546

Terms. U.S.VISA. MC. BAAC Check Money Order U.S. Funds Only. CA residents add 6% Sales Tax. MINIMUM PREPAID ORDER \$15.00. Include MINIMUM SHIPPING & HANDLING of \$2.50 for the first 3 lbs. plus 25¢ for each additional pound. Orders over 50 lbs. sent freight collect. Just in case, please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru December, 1981. SOCKET and CONNECTOR prices based on GOLD, not exceeding \$700.00 per oz. Sales Prices Valid only if YOU mention publication and month. Credit Card order will be charged appropriate freight.



PRIORITY ONE ELECTRONICS

BUY WITH CONFIDENCE
From the Nation's Largest

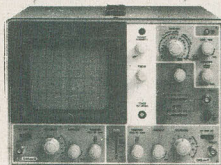
HITACHI Distributor
Hitachi Denshi, Ltd.

Single and dual trace, 15 thru 100 MHz. All high sensitivity Hitachi oscilloscopes are built to demanding Hitachi quality standards and are backed by a 2-year warranty. They're able to measure signals as low as 1mV/division (with X5 vertical magnifier). It's a specification you won't find on any other 15 or 30 MHz scopes. Plus, Z-axis modulation, trace rotation, front panel X-Y operation for all scopemodels, and X10 sweep magnification. And, 30 thru 100 MHz oscilloscopes offer internal signal delay lines. For ease of operation, functionally related controls are grouped into three blocks on the color coded front panel. Now here's the clincher: For what you'd expect to pay more, you actually pay less. Check our scopes before you decide. All scopes complete with probes.

HITV302B

List \$995.00

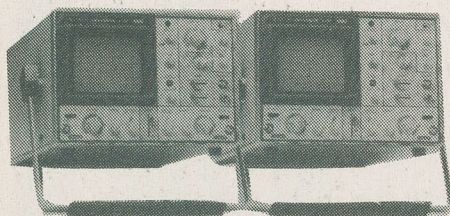
Our Price: \$859.00



TV sync-separator circuit
High-sensitivity 1mV/div (5MHz)
Sweep-time magnifier (10 times)
Z-axis input (intensity modulation)
Signal delay line
Complete with 2 probes
CH1, CH2, DUAL, ADD, DIFF, Vertical
Deflection Modes
X-Y operation
Trace Rotation

30 MHz DUAL TRACE OSCILLOSCOPE

Hitachi... The measure of quality.
HITV152B DUAL TRACE 15MHz (no delay)
LIST \$735.00 **OUR PRICE \$629.00**



HIT-V352 35MHz DUAL TRACE WITH DELAY

LIST PRICE: \$1150.00
OUR PRICE: \$998.00

Economically priced dual trace oscilloscope. Square CRT with internal graticule (illuminated scale). High-accuracy voltage axis & time axis set at #3% (certified at 10° to 35° C). High-sensitivity 1mV/div. Low drift. 2 Year Warranty.

HIT-V202 20MHz DUAL TRACE

LIST PRICE: \$850
OUR PRICE: \$765

Dynamic range 8 div. TV sync separator circuit. Built-in signal delay line (V-352). X-Y operation. Sweep-time magnifier (10 times). Trace rotation system. Fine adjusting, click-positioning function.

50 MHz & 100 MHz DUAL TRACE WITH CALIBRATED TIME DELAY

HIT V550B
50MHz with
3rd TRACE
TRIGGER VIEW
LIST \$1745.00
**SALE
CALL**

HIT V1050
100MHz with
3rd & 4th TRACE
TRIGGER VIEW
LIST \$2390.00
**SALE
CALL**

The HITACHI V550B (50MHz) and V1050 (100MHz) offer all the capabilities you might expect from a lab grade oscilloscope. Capabilities such as 3rd trace trigger view, a bright 6" square CRT, and a max sweep rate of 2ns/div (V1050) 5ns/div (V550B). Also, features you may not expect like, sensitivity of 1mV/div (V550B) .5mV/div (V1050) @ 10MHz, automatic focus correction.



OKIDATA MICROLINE PRINTERS

WITH FRICTION AND TRACTOR FEED

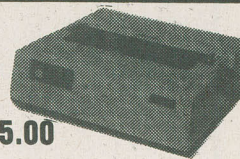
- Bi-DIRECTIONAL - 120 CPS
- 9 x 9 Matrix (Alphanumeric)
- 6 x 9 or 12 Matrix for Graphics
- 5, 8, 3, 10, 16 Characters Per Inch
- 6 or 8 Lines Per Inch
- 80 CPL @ 10 CPI for 82A
- 132-CPL @ 10 CPI for 83A
- Parallel and Serial I/O
- 110 Through 1200 Baud
- Self Test
- Out of Paper Switch
- Friction or Tractor Feed
- 3" to 14" Top of Form (Switch Selectable)
- 10 Different Character Sets

OKIDAT82AT
80 CPL @ 10 CPI

\$575.00

OKIDAT83AT
132 CPL @ 10 CPI

\$775.00



Nine functions:

1. dc voltage
2. ac voltage
3. dc current
4. ac current
5. resistance
6. diode test
7. conductance (I-R)
8. logic level and
9. temperature (K-type thermocouple)
10. Peak hold on voltage and current functions
11. Selectable audible indicator for continuity or level detection
12. 3 1/2-digit resolution
13. 0.1% basic accuracy
14. LCD display
15. Overload protection
16. Safety designed test leads

DMM



FLU-D800 (Funct. 1-6)	\$125.00
FLU-D802 (Funct. 1-7)	\$189.00
FLU-D804 (Funct. 1-9)	\$249.00
FLU-D810 (RMS Bench 10A)	\$269.00
FLU-D811 (RMS Bench w/Batt.)	\$309.00
FLU C90 (Case for D800, 802, 804)	\$10.00
FLUY-8205 (Case for D810, 811)	\$35.00

The Industry Challenge: Make it smaller. Make it better
Make it cost less



MS-230. A whale of a miniscopes

With our ingenious new MS-230, 30-megahertz, battery-operated dual-trace miniscopes, portability suddenly isn't a problem anymore. At 3 lbs. 10 oz., it's the smallest, lightest miniscopes in the field today. The state-of-the-art MS-230 works wonders on site or in the shop. Anywhere there's a need to accurately test or measure electronics equipment.

The versatile MS-230 is perfect for TV repairmen. Services micro-computer systems when the chips are down. Maintains avionics equipment with flying colors. And diagnosis sophisticated medical equipment with the precision of a surgeon.

However, if your budget or needs demand something more economical or less sophisticated, chances are the MS-215 dual-trace or MS-15 single-trace will fit the bill.

PART #	LIST PRICE	OUR PRICE
* NLSMS230 30 MHz DualTrace Miniscope	\$649.00	\$579.00
* NLSMS215 15 MHz Dual Trace Miniscope	\$497.00	\$439.00
* NLSM15 15 MHz Single Trace Miniscope	\$389.00	\$345.00
*Typical 3 dB point is 8 MHz at 2-division deflection. Typical maximum frequency for full scale (4div) deflection is 2 MHz.		
NLS41141 Deluxe 10 to 1 100MHz probe	\$30.00	\$45.00
NLS41140 Leather case for MS15 & MS215	\$45.00	\$45.00
NLS41180 Leather case for MS230	\$45.00	\$45.00

The remarkable Touch Test 20 DMM.

With the Touch Test 20, Non-Linear Systems introduces the 2 lb. 4 oz. test lab. Now with 20 keytest functions at your fingertips (plus the ability to measure 10 electrical parameters and 44 ranges), you can take one lab to the field instead of a cumbersome collection of individual testers.

Another bright idea. The Touch Test 20 is the only DMM with light pressure touch function selection. No more dials to fiddle with. Instead, an LED shows the function you choose. And when you switch, you get an audible beep and visual blip to let you know.

This small wonder is miniaturization at its best. The new Touch Test 20 is the most innovative portable/bench-type multimeter in the industry today. TOUCH/TEST 20 comes complete with Test Leads, Temperature Probe, and component Test Adaptor, (LED Display).

PART #	LIST PRICE	OUR PRICE
NLS TT20	\$435.00	\$390.00
NLS TT20B	\$467.00	\$420.00
LCD Display (B Models with rechargeable batteries & charger)		
NLS TT21	\$495.00	\$455.00
NLS TT21B	\$525.00	\$475.00
NLS 41140 Leather Carrying Case		\$45.00

DISCOUNT COUPON

SAVE UP TO 10%

From Our December **RADIO ELECTRONICS AD**

- ☐ \$100 - \$149.99 Deduct \$10.00
- ☐ \$150 - \$199.99 Deduct \$15.00
- ☐ \$200 - \$299.99 Deduct \$20.00
- ☐ \$300 - \$399.99 Deduct \$30.00
- ☐ \$400 - \$499.99 Deduct \$40.00
- ☐ \$500 & UP Deduct \$10%

**VALID ON PREPAID
U.S. MAIL ORDERS
RECEIVED BEFORE
DECEMBER 31, 1981**

OR PRESENT THIS COUPON
AT OUR RETAIL STORE BEFORE
DECEMBER 31, 1981

Coupon valid only when attached to
face of order.

REDISC

Sorry, Discount Coupon Not Valid on
Shipping Charges, Phone or Foreign orders

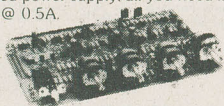
RE8112

CIRCLE 12 ON FREE INFORMATION CARD

LOW TIM DC STEREO PRE-AMP KIT TA-10 20

Incorporates brand-new D.C. design that gives a frequency response from 0Hz-100KHz ± 0.5 dB! Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuation! Specifications: • T.H.D. less than .005% • T.I.M. less than .005% • Frequency response: DC to 100KHz ± 0.5 dB • RIAA deviation: ± 0.2 dB • S/N ratio: better than 70dB • Sensitivity: Phono 2MV 47K/Aux. 100MV 100K • Output level: 1.3V • Max output: 15V • Tone control: bass ± 10 dB @ 50Hz/treble ± 10 dB @ 15Hz • Power supply: ± 24 D.C. @ 0.5A
Kit comes with regulated power supply, all you need is a 48V C.T. transformer @ 0.5A.

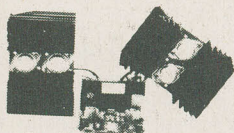
ONLY \$44.50
X'former
\$4.50 ea.



100W CLASS A POWER AMP KIT

Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low T.I.M. stereo pre-amp

- Specifications:
- Output power: 100W RMS into 8-ohm 125W RMS into 4-ohm
 - Frequency response: 10Hz-100KHz
 - T.H.D.: less than 0.008%
 - S/N ratio: better than 80dB
 - Input sensitivity: 1V max.
 - Power supply: ± 40 V @ 5 amp
 - One channel, needs two for stereo



TA-1000KIT
\$51.95
Power
transformer
\$24.00 each

50 WATTS AUTO STEREO BOOSTER BY VERTRONIX

- Specifications: • 50 watts RMS total (25W + 25W)
• Frequency Response: ± 0.5 dB, 20Hz ~ 20KHz
• T.H.D.: 0.2% at full rated output
• Input Impedance: 20K ohms
• Crosstalk: Better than 90dB
• Sensitivity: 1.5V for full rated output
• S/N Ratio: Greater than 95dB
• Speaker Load: 2 ~ 8 ohms
• Voltage Supply: 9 ~ 18V D.C.

Model V-Amp 500

REG. PRICE
\$119.00 EACH
OUR SPECIAL PRICE
\$55.00 EACH

"FISHER" 30 WATT STEREO AMP MAIN AMP (15W x 2)



Super Buy
Only \$18.50

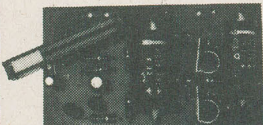
5W AUDIO AMP KIT

2 LM 380 with Volume Control
Power Supply 6 ~ 18V DC

ONLY
\$6.00 EACH

2 WATT AUDIO AMP

Pre assembled units. All you need is to hook up the speaker and the volume control. Supply voltage from 9 ~ 15V D.C. measures only 2" x 3 1/2", making it good for portable or discrete applications. Comes with hook up data.



BUY 2 FOR
\$4.99

1 WATT AUDIO AMP

All parts are pre-assembled on a mini PC Board. Supply Voltage 6 ~ 9V D.C.
SPECIAL PRICE \$1.95 ea.



NEW MARK III 9 Steps 4 Colors LED VU

Stereo level indicator kit with arc-shape display panel!!! This Mark III LED level indicator is a new design PC board with an arc-shape 4 colors LED display (change color from red, yellow, green and the peak output indicated by rose). The power range is very large from -30dB to +5dB. The Mark III indicator is applicable to 1 watt - 200 watts amplifier operating voltage is 3V-9V DC at max 400 MA. The circuit uses 10 LEDs per channel. It is very easy to connect to the amplifier. Just hook up with the speaker output!

IN KIT FORM \$18.50

MARK IV 15 STEPS LED POWER LEVEL INDICATOR KIT

This new stereo level indicator kit consists of 36 4-color LED (15 per channel) to indicate the sound level output of your amplifier from -36dB +3dB. Comes with a well-designed silk screen printed plastic panel and has a selector switch to allow floating or gradual output indicating. Power supply is 6 ~ 12V D.C. with THG on board input sensitivity controls. This unit can work with any amplifier from 1W to 200W!

Kit includes 70 pcs. driver transistors, 38 pcs. matched 4-color LED, all other electronic components, PC board and front panel.



MARK IV KIT
\$31.50

MARK V 15 STEPS LED POWER OUTPUT INDICATOR KIT

All functions same as Mark IV but this is with heavy duty aluminum front plate and case. Can be easily slot into the front panel of your auto, truck or boat. Operates on 12V DC.



\$41.50 EACH KIT

SOLID STATE STEREO GRAPHIC EQUALIZER PRE AMP KIT TA-2500

- Specifications:
- Total Harmonic Distortion: Less than 0.05%
 - Intermodulation Distortion: (70Hz:7KHz = 4:1 SMPTE Method) Less than 0.03%
 - Frequency Response: Overall 10Hz ~ 100KHz ± 0.5 dB, -1dB
 - RIAA Curve Deviation: (Phono) +0.2dB, -0.2dB (30Hz ~ 15KHz)
 - Channel separation (at rated output 1KHz)
 - Phono, Tuner, Aux and Tape Monitor better than 70dB.
 - Input sensitivity and impedance (1KHz for rated output) Phono: 2MV 47K ohms Aux: 130MV 50K ohms Tuner: 130MV 50K ohms Tape: 130MV 50K ohms
 - Graphic Equalizer control: 10 Band Slide Control Frequency Bands: 31.5Hz; G3Hz; 125Hz; 250Hz; 500Hz; 1KHz; 2KHz; 4KHz; 8KHz; 16KHz also with on panel selector for Phono, Tuner, Aux 1 and Aux 2.
 - Power Supply: 117 VAC
 - Kit comes with all electronic components, transformer, instructions and a 19" rack mount type metal cabinet.



MODEL TA-2500
\$119.00 PER KIT

ELECTRONIC DUAL SPEAKER PROTECTOR

Cut off when circuit is shorted or over load to protect your amplifier as well as your speakers. A must for OCL circuits.

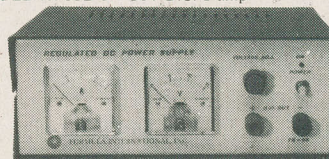


KIT FORM \$8.75 EA.

PROFESSIONAL REGULATED VARIABLE D.C. POWER SUPPLY KIT

All solid state circuitry with high efficiency power transistor 2SD388 and I.C. voltage regulator MC1733. Output voltage can be adjusted from 0-30V at 1 amp current limited or 0-15V at 2 amp current limited. Internal resistance is less than 0.005 ohm; ripple and noise less than 1 MV, dual on panel meter for voltage and amp reading, also with on board LED and audible over load indicator. Kit comes with predrilled P.C. board, instructions, all necessary electronic components, transformer and a professional look metal cabinet. The best project for school and the most useful instrument for repairman. Build one today!

MODEL TR 88A 0 ~ 15V D.C. 2 amp
MODEL TR 88B 0 ~ 30V D.C. 1 amp



\$59.50 PER KIT

REGULATED DUAL VOLTAGE SUPPLY KIT

± 4 ~ 30V DC 800 MA adjustable, fully regulated by Fairchild 78MG and 79MG voltage regulator I.C. Kit includes all electronic parts, transformer and all electronic components, filter capacitors, I.C. heat sinks and P.C. board.



\$12.50 PER KIT

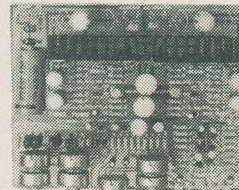
POWER SUPPLY KIT

0-30V D.C. REGULATED
Uses UA723 and ZN3055 Power TR
output can be adjusted from 0-30V. 2 AMP. Complete with PC board and all electronic parts. Transformer for Power Supply. 2 AMP 24V x 2 **\$9.50**



0-30 Power Supply
\$10.50 each

TA-323 6 WATTS TOTAL 30W + 30W STEREO AMP KIT



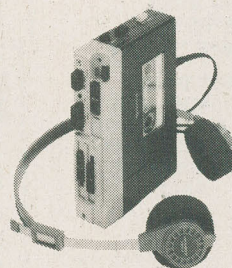
★ SPECIAL ★
EXCELLENT
PRICE!

MODEL 001-0034
Transformer (Optional)

This is a solid state all transistor circuitry with on board stereo pre-amp for most microphone or phone input. Power output employs 2 pairs matching Darlington Transistors. Driven by the popular 2N3053 Driver Transistors. Four built on board controls for: volume, balance, treble and bass. Power supplies requires 48 VET 2.5 amp transformer. T.H.D. of less than 0.1% between 100 Hz and 10KHz at full power. (30 Watts + 30 Watts loaded by 8 Ω).

\$29.50 PER KIT
\$10.50 EACH

POCKET STEREO CASSETTE PLAYER WITH STEREO HEAD PHONE



This unit is a high fidelity stereo player which will give you years of listening pleasure and follow you wherever you go. Made by the same company in Japan who use the "Big Name." Complete set comes with 1 Stereo head-phone, 3 AA size alkaline batteries, 1 leather like carrying case for player and 1 carrying case for storage of 4 cassette tapes and 1 demo tape.

MODEL SWM-33
OUR DIRECT IMPORT PRICE

\$67.50



FORMULA INTERNATIONAL INC.

11/81

	SHIPPING AND HANDLING CHARGES
Under \$50.00 purchase	5%
Over \$50.00 purchase	10%
Outside Calif. (includes Mexico & Canada)	15%
Overseas	25%

Minimum Order \$10.00/Calif. Residents Add 6% Sales Tax
Phone Orders Accepted on Visa or MC ONLY. NO C.O.D./Store Hours 10-7 Mon. thru Sat.

12603 CRENSHAW BLVD., HAWTHORNE, CA 90250
PHONE: (213) 973-1921 • (213) 679-5162

Send \$1.00
For Detailed
Catalogue



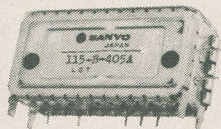
FOR COMMERCIAL FREE TV BOX BUILDERS

MC 1358	\$2.50	LM 7815	\$1.20
MC 1350	\$2.00	NE 565	\$2.00
MC 1330	\$3.00	Connectors Set	\$1.00
LM 1458	\$1.00	I.C. Socket Set	\$2.00
LM 380	\$2.00	Matching Transformer	\$1.40
Sanyo UHF Tuner	\$35.00	Tolrid Coils	
Capacitors Set	\$12.50	(Set of 4)	\$3.00
Resistors Set	\$2.00	Speaker Cabinet	\$12.95
Trim Pots		Transformer	
Trim Caps Set	\$13.50	18V 800MA	\$3.00
Pots and Knobs	\$2.00		

We sell you all the above components in a package for **\$125.00** and you will receive a free predrilled P.C. board and instructions at no charge!

SANYO UHF VARACTOR TUNER

For UHF CH 14 83
Tuning voltage +1V~+28V D.C. Input impedance 75 OHM. I.F. band width 7~16 MHz. Noise figure 11.5dB MAX. Size 2 3/4" x 1 1/4" x 3/4". Supply voltage 15V D.C. Sound I.F. = 58.0 MHz. Video I.F. = 62.5 MHz.

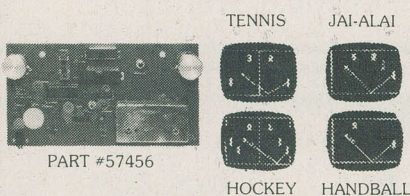


All units are brand new from Sanyo.
MODEL 115-B-405A
\$35.00 EACH

Tuner is the most important part for the circuit. Don't let those \$19.00 tuners fool you!

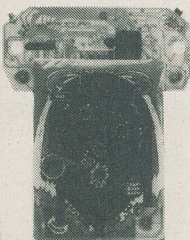
TV GAME BOARD

PLAYS 4 GAMES: TENNIS; HOCKEY; HANDBALL AND JAI-ALAI.
All boards complete with all parts ready to play. Requires 6C size batteries and a small speaker for sound effects. The boards were surplus from a famous game manufacturer. They will play on all US standard black and white or color TV sets. (Regular price for these games were \$39.50 each)
OUR PRICE ONLY \$6.50 EACH



PART #57456

ELECTRONIC PIN BALL MACHINE

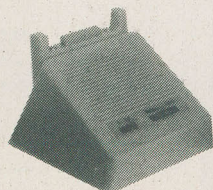


That sounds and plays like the real thing. All units are brand new but without the case. Functions of the game include double flipper control, kicker control, 1-4 players, 3 speed ball control, tilt switch, automatic score, extra bonus cave and many more. All solid state with LED panel, no moving parts. Requires 9V battery to operate, speaker not included.

A perfect gift for yourself or friends.
SPECIAL **\$8.99 EACH** SPEAKER **\$1.25 EACH**

ELECTRONIC MUSICAL TELEPHONE REST KIT

This telephone rest can be used as a door charm, an audible indicator and for many other sound projects. The special custom made I.C. is pre programmed with 4 musical tunes. Kit comes with a nice looking plastic case, pre-drilled P.C. board, volume control, special sound I.C. speakers and all electronic components and instructions. Ideal for home or school projects.



MODEL FIH-3000

**BUY
NOW!**
**SPECIAL
PRICE!
ONLY**
\$15.50 PER KIT

DIGITAL TIMER/CLOCK

- 24 Hour preset time to turn on or off
- 12 Hour green 0.5" display for time
- operated on 12~16V A.C.

The whole timer is self contained in a compact plastic case (as seen in photo). Designed for VTR with push button switch for easy setting. Limited quantity available.



NOW ONLY \$12.94 MODEL VEQ 0143

SANYO ANTENNA SIGNAL BOOSTER

This Booster is specially designed for UHF Channels (14-83). After installed this unit (between the antenna input cable and the UHF tuner) will have a minimum of 10dB gain, that is approximately 2 times better than what you are seeing now. Ideal for those who live in apartments that cannot put up an outdoor antenna. Size is so small; only 2" x 1 1/2" x 1". Supply voltage is 15 VDC.



★ NEW ITEM ★

MODEL 001-0076

\$12.50 EACH

13 FUNCTIONS LCD TIME MODULE



MODEL 001-0062

\$7.94 EACH

- Displays month, date and day of the week
- Displays hour, minute and second
- AM, PM Indicator
- Alarm 1 and Alarm 2 (Independent)
- 10 Hours Stop Watch
- 12 Hours presettable count down time
- Hour Charm Indicator
- Back light by touch of the switch

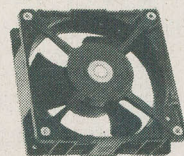
These modules are brand new and made by LITRONIX. Designed for a man's watch. Can be used for many applications. Comes with 2 silver batteries and the ceramic round transducer.

MATCHED PAIR POWER TRANSISTORS BY MOTOROLA

MJ2955 PNP 150 Watts BV=60 V	\$3.50
2N3055 NPN I.C.=15 A	per pair
MJE2955 PNP 90 Watts BV=60 V	\$3.00
MJE3055 NPN I.C.=10 A	per pair
MJ15003 NPN 250 Watts BV=140 V	\$12.00
MJ15004 PNP I.C.=20 A	per pair

All above parts guaranteed to be prime and come with data sheets.

MUFFIN FANS FOR EQUIPMENT COOLING



These fans are pulled out from used computers. But carefully cleaned by ultrasonic cleaner. All in "like-new" condition. Size 4 11/16" x 1 1/2" x 4 11/16".
MODEL MF505
\$9.50 EACH

FLUORESCENT LIGHT DRIVER KIT

12V DC POWERED
Lights up 8~15 Watt Fluorescent Light Tubes. Ideal for camper, outdoor, auto or boat. Kit includes high voltage coil, power transistor, heat sink, all other electronic parts and PC Board. light tube not included!

\$6.50 Per Kit

PRESS-A-LIGHT SELF GENERATED FLASHLIGHT

Never worry about battery. EXCLUSIVE! **\$3.95 ea.**
because it has none! Easy to carry in pocket and handy to use. Ideal for emergency light. It generates its own electricity by squeezing grip lever. Put one in your car, boat, camper or home. You may need it some time!



Model F-179



FORMULA INTERNATIONAL INC.

	SHIPPING AND HANDLING CHARGES	
	Under \$50.00 purchase	Over \$50.00 purchase
Inside California	10%	5%
Outside Calif. (includes Mexico & Canada)	15%	10%
Overseas	25%	20%

Minimum Order \$10.00/Calif. Residents Add 6% Sales Tax.
Phone Orders Accepted on Visa or MC ONLY. NO C.O.D./Store Hours 10-7 Mon. thru Sat.
12603 CRENSHAW BLVD., HAWTHORNE, CA 90250
PHONE: (213) 973-1921 • (213) 679-5162



CRYSTAL CONTROLLED WIRELESS MICROPHONE SYSTEM

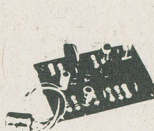
No FCC license required.
OUR PRICE
\$49.50
ADDITIONAL
MICROPHONE
(TRANSMITTER)
AVAILABLE
AT **\$28.00 EACH**



MURA WMS-49

Transmitter: FET mic for flat 30 ~18 KHz response extra controlled 49MHz AM Band for drift-free performance. 100 MW output (range approx. 1/4 mile) for reliable long range transmission. Powered by a 9V radio battery (included).
Receiver: Extra controlled locks on 49MHz transmitter signal. With on panel VU meter monitors the signal strength from the microphone. Standard phone jack outlet connection to a P.A. or other phone input. 9V battery included. This professional set is ideal for on stage, in field, church, in house or outdoor use.

SUPER FM WIRELESS MIC KIT— MARK III



FMC-105

This new designed circuit uses high FEQ. FET transistors with 2 stages pre amp. Transmits FM Range (88-120 MHz) up to 2 blocks away and with the ultra sensitive condenser microphone that comes with the kit, allows you to pick up any sound within 15 ft. away! Kit includes all electronic parts, OSC coils, and P.C. Board. Power supply 9V D.C.

\$11.50 PER KIT

WEM-36 FM WIRELESS MICROPHONE

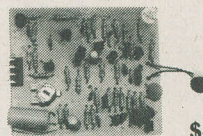
TEET MODEL WEM-36 is a factory assembled FM wireless microphone powered by two AA size batteries. Transmits in the range of 88-108 MHz with 3 transistor circuits to meet with F.C.C. part 15 regulations. Element is built in a plastic tube type case with an omni-directional electret condenser microphone unit. By using a standard FM radio, signal can be heard anywhere on a one-acre lot. Sound quality was judged "very good."

MODEL WEM-36

\$16.50 EACH

WHISTLE ACTIVATED SWITCH BOARD

All boards are pre-assembled and tested. Your whistle to its FET condenser microphone from a distance, as far as 30 feet away (sensitivity can be easily adjusted) will turn the switch on, then match your whistle to it again, then it turns off. Ideal for remote control toys, electrical appliance such as lights, coffee pots, TV, Hi-Fi, radio or other projects. Unit works on 9V D.C.



MODEL 968

\$4.50 EACH

ULTRASONIC SWITCH KIT

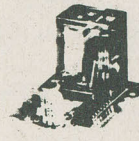
Kit includes the Ultra Sonic Transducers, 2 PC Boards for transmitter and receiver. All electronic parts and instructions. Easy to build and a lot of uses such as remote control for TV, garage door, alarm system or counter. Unit operates by 9-12 DC.

\$15.50

ELECTRONIC SWITCH KIT

CONDENSER TYPE
Touch On Touch Off
uses 7473 I.C. and
12V relay

\$5.50 each



11/81
Send \$1.00
For Detailed
Catalogue



★ **QUALITY parts at DISCOUNT PRICES!** ★

4PDT PRINTED CIRCUIT 12 VDC

14 pin style
3 amp contacts
BRAND NEW
P.C. Mount
\$2.75 EA.

DPDT RELAY AROMAT 12 VDC HL2-P-DC12VDC

compact size
10 amp contacts
P.C. mount
\$3.00 each

4PDT RELAY

14 pin style
3 amp contacts
24 volt d.c. or 120 volt a.c. coil
Used but fully tested
\$1.70 EACH
specify coil voltage
LARGE QUANTITIES AVAILABLE
SOCKETS FOR RELAY 50¢ each

TRANSFORMERS

120 volt primaries
6 VOLTS at 150 mA \$1.25
12 V.C.T. at 500 mA \$2.50
16.5 V. at 3 AMPS \$6.50
18 VOLTS at 2 AMP \$4.50
25.2 V.C.T. at 1.8 AMP \$5.50

440/220 TO 110 VOLT TRANSFORMER
SOLA # HTB2100
440 or 220 volts to 110 volts
Rated 100 VA
\$15.00

KEY SWITCH S.P.S.T.

RATED 4 AMPS
125 VOLTS
\$3.50 EA.

MINI SIZE BUZZERS

1/2 to 3 volts 75¢ ea
WITH WIRE LEADS
1/2 to 3 volts 75¢ ea
WITH PIN TERMINALS
3 to 7 volts 75¢ each
WITH PIN TERMINALS

COMPUTER GRADE CAPACITOR

1,700 mfd. 150 VDC
2 1/2" DIA. X 4 3/4" \$2.00
3,600 mfd. 40VDC \$1.00
1 3/8" DIA. X 3" HI
6,400 mfd. 60VDC \$2.50
1 3/8" DIA. X 4 1/4" HI
11,500 mfd. 18VDC \$1.50
1 3/8" DIA. X 3 1/4" HI
20,000 mfd. 25VDC \$2.00
2" DIA. X 2 1/2" HIGH
22,000 mfd. 25VDC \$2.50
2" DIA. X 2 1/2" HIGH
22,000 mfd. 40VDC \$3.00
2" DIA. X 6" HIGH
45,000 mfd. 25 VDC \$3.50
2" DIA. X 4" HIGH
52,000 mfd. 15 VDC \$3.00
2" DIA. X 4 1/2" HIGH
72,000 mfd. 15VDC \$3.50
2" DIA. X 4" HIGH
CLAMPS TO FIT CAPACITORS 50¢ ea

SEND FOR OUR NEW Free! 40 PAGE CATALOG Free!

TYPE N CONNECTOR

KINGS UG526 B/U
FITS RG55, RG58, RG141, RG142, RG223
SOLDER TYPE
\$1.75 EACH
10 for \$16.00

RFI LINE FILTER

for line to line & line to ground noise suppression
CORCOM #10K6
Rated: 10 amp
115/250 v 50-400 hz
\$3.75 ea. 10 for \$35.00

SUPER SMALL PHOTO-FLASH

170 MFD 330 VOLT
1 1/4" X 7/8"
2 for \$1.50
10 for \$7.00

750 MFD 330 V PHOTO FLASH

2" HIGH X 1 1/4" DIA.
\$1.25 EACH
10 FOR \$11.00

***SPECIAL!!* 10 MEG POTS**

4 for \$1.00
10 for \$2.00
100 for \$15.00

2" DIA. 1/2VDC BUZZER SPECIAL!

50¢ each
10 for \$4.00
100 for \$35.00

2" ALLIGATOR CLIPS

7 clips for \$1.00
100 clips for \$12.00
500 clips for \$50.00

L.E.D.'s STANDARD JUMBO DIFFUSED

RED 10 FOR \$1.50
GREEN 10 FOR \$2.00
YELLOW 10 FOR \$2.00

FLASHER LED 5 VOLT OPERATION JUMBO SIZE

2 FOR \$1.70

BI POLAR LED SUB MINI LED

.079" X .098"
20mA at 1.75v
10 FOR \$1.00
200 FOR \$18.00
QUANTITY PRICES AVAILABLE

CANNON XLR CONNECTOR

3 PRONG CHASSIS MOUNT CONNECTOR
\$200 EACH
10 for \$19.00

RECHARGEABLE SEALED LEAD-ACID BATTERIES

6 VOLTS 6 AMP/HR
3 1/2 X 2 X 4 1/2 IN. \$10.00
6 VOLTS 7 1/2 AMP/HR
4 1/2 X 2 X 4 1/2 IN. \$12.50

MRF 901

\$3.00 EA.

ALL ELECTRONICS CORP.

905 S. Vermont Ave.
P.O. BOX 20406
Los Angeles, Calif. 90006
(213) 380-8000

Mon. - Fri. 9 AM - 5 PM
Saturday 10 AM - 3 PM

TERMS
• Quantities Limited
• Min Order \$10.00
• Add \$2.50 Shipping USA
• Calif. Res. Add 6%
• Prompt Shipping

KNAPP ELECTRONIC PARTS

Modutec Meter

2 1/2 x 3"
100 ua. @ 600 ohm I.R.
\$3.95

Capacitor

5200 mf 25v.
red or black
.49

5 Way Binding Posts

red or black
.23

Jumbo LEDs

red diffused
100 @ 3v. \$10/1.00
100 @ 8.00
6.8, 10, 15, 22, 33, 47, @ 6.3v.
22, 68 @ 10v.
1.5, 3.3, 4.7, 6.8 @ 16v.
15 @ 20v.
47, 68, 1.5, 2.2, 3.3, 4.7, 6.8 @ 35v.
22, 68, 1 @ 50v.

Dip Tantalum Caps

dipped and solid
100 @ 3v. \$10/1.00
6.8, 10, 15, 22, 33, 47, @ 6.3v.
22, 68 @ 10v.
1.5, 3.3, 4.7, 6.8 @ 16v.
15 @ 20v.
47, 68, 1.5, 2.2, 3.3, 4.7, 6.8 @ 35v.
22, 68, 1 @ 50v.

Popular Transistors

2N2219A TO 39 4/\$1.00
ECG128 TO 39 79
ECG123AP TO 18 4/\$1.00
ECG159 TO 18 4/\$1.00
ECG130 TO 3 79
ECG129 TO 220 79
2N2222 or 2N2907 TO 926/\$1.00

Relays

Potter/Brumfield
KH-5870 12v/DPDT
or
Dunn Reed
MRRSIA103 24v/SPST
.99

Game Boards

IC Games by Milton Bradley, Simon, Computer Perfect, Comp. Mind, Starsound.
BARGAIN COLLECTION!
100% PERFECT! 6/\$2.95

Power One

5v. 6AMP power supply
reg. 5% accuracy \$23.50

Mura Cordless Telephone System

AS IS complete
\$43.50
\$199.95 Retail

Micro Switches

mini OMRON S55 w/lever
micro switch #62 + V3
cherry E23
.49 or 10 assorted \$3.50

Voltage Regulator

ideal for battery charging
13.7 v.
TO-3 3AMP \$1.09

Dip Switch

5 posit. .89
699
8 \$1.09

Mini Solid State Buzzer

12v.
.98

Circuit Breakers

auto reset
sealed glass
1/5/10/20 AMP 10/\$3.50

Low Profile Dip Sockets

14 pin 18 .w/w. .29
16 pin 22 .w/w. .31
18 pin 22 or 10/\$1.00
24 pin 50
40 pin 50
42 pin flat 19 or 10/\$1.00
EDGE CONNECTORS
15/30 pin AMP edge conn. gold w/w. .89
36/72 pin double winchester edge gold S.T. \$2.25
40/80 pin winchester gold w/w \$2.95

Toggle Switches

SPST 79
SPDT mom. center off. .99
SPDT .. center off. .99
SPDT 99
SPDT 99
SPDT .. 10 AMP. .1.19
DPDT 1.95
DPDT .. center off. .2.09
3PDT 1.95
4PDT 1.95

SEND FOR FREE CATALOG

Or Call Us At (813) 392-0406

H.J. Knapp of Florida Inc.

4750 96th St. N. St. Petersburg, Florida 33708

CIRCLE 21 ON FREE INFORMATION CARD

T-1300 4-1/2 LB
GREAT FOR 5V AT 6A OR 12V AT 4A
\$6.95

2-18VCT 2 AMP WINDINGS

C-4444 5 LB
WOW!
\$9.95

INSTRUMENT CASE
BRAND NEW, HIGH QUALITY
TWO-TONE BLUE CASES AT A FRACTION OF THEIR WORTH
FRONT PANEL IS PUNCHED, BUT REPLACES WITH TWO SCREWS. BACK HAS BANANA JACKS AND CORD WINDER.
5" X 7" X 12"

56 PIN GOLD BIFURCATED CONTACTS, GOLD SOLDER TERMINALS. MFD BY AMPHENOL
156" CENTERS
C-2128, 2 02
GOLD Edge CONNECTORS
\$1.75

50 PIN GOLD WIREWRAP
156" CENTERS, GOLD BIFURCATED CONTACTS MFD BY CINC
C-2125
\$1.75

CALL OR WRITE FOR OUR FANTASTIC PRICES
ATARI AND OHIO SCIENTIFIC
EPSON MX-80 \$499

RELAY
SPST 720J 12V COIL
VERY SENSITIVE
SIZE 1-1/8 X 1/2 X 1/2
PC MT R-1201
\$2

Memory VHF/UHF -TUNER- ASSEMBLY
FANTASTIC DEAL ON A COMPLETE NEW SONY MEMORY TUNER!
FEATURES VHF AND UHF VARIATOR TUNERS, DIGITAL SCANNING TUNING CIRCUITS WITH MEMORY, ALL CONTROLS AND INDICATORS INCLUDED! SUPPLIED WITH SCHEMATICS, INSTRUCTIONS, OWNERS MANUAL. VHF/UHF ANTENNA IN, IF OUT. BRAND NEW CURRENT PRODUCTION FROM MODEL #KV-1217. GREAT ADD-ON TO ANY TV!
2 LB X-1000 \$39

X-4900 9 LB
\$49
5 Volt 12 Amp Power Supply
NEW ELAPC MODEL SOLV 60-5 FEATURES
* 0.1% LINE & LOAD REGULATION, CURRENT LIMITING, REMOTE SENSING, 120/240 VAC INPUT. OUR PRICE IS WAY BELOW DEALER COST!

Mini Relay
12v DPDT
R-1200
PC MOUNT
HERMETIC METAL CAN
SIZE: 3/4 X 3/8 X 3/8
\$2

2114-L
300 NS
\$2

-GOLD- WIREWRAP PROTO-BOARDS
UNBELIEVABLE DEAL ON SUPER QUALITY WIREWRAP BOARDS
OVER 100, 16 PIN GOLD W/ (3-LEVEL) SOCKETS (UP TO 120) MTD ON A PCB WITH HEAVILY BYPASSED POWER BUSES, 260 WW I/O PINS LEADING TO GOLD EDGE CONTACTS. USE AS SUPER PROTO-BOARD, OR CAN BE EASILY DISASSEMBLED FOR PARTS. EITHER WAY ITS A STEAL!
BOARD SIZE IS 15" X 6-1/2"
X-1045 \$99
ENLARGED VIEW
\$49

TANTALUM CAPACITORS -DIPPED-

MFD	PRICE	MFD	PRICE
6 VOLT	10 VOLT		
6.8 25¢	4.7 25¢		
47 35¢	6.8 27¢		
150 45¢	100 55¢		
330 75¢			
15 VOLT	10 VOLT		
3.3 25¢	4.7 28¢		
3.3 28¢	1.0 25¢		
10 30¢	2.2 30¢		
33 35¢	3.3 30¢		
2.2 25¢	47 25¢		
3.3 28¢	1.0 25¢		
10 30¢	2.2 30¢		
33 35¢	3.3 30¢		
AXIAL CS-13	4.7 30¢		
.068/35V 25¢	22 40¢		
1.0/50V 30¢			
6.8/35V 35¢			

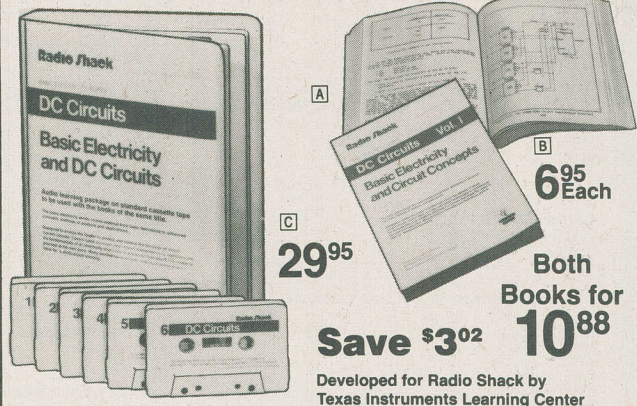
Aluminum Electrolytic -GRAB BAG-
NONE SMALLER THAN 1,000 MFD. NO VOLTAGES BELOW 25VDC. BAG OF 4 WORTH \$5
BAG OF 4 \$100/20
WT 1-3/4 LB WT 40 POUNDS

DIAMONDBACK ELECTRONICS COMPANY
PO BOX 12095
SARASOTA, FL 33578
PHONE ORDERS 813-953-2829
CONTINENTAL US ADD \$2.25 FOR THE FIRST LB & \$26 FOR EACH EXTRA POUND
WEST COAST ADD \$3 FOR THE FIRST LB & \$25 FOR EACH ADDITIONAL POUND
FREE CATALOG

CIRCLE 19 ON FREE INFORMATION CARD

Builders! Start Your Holiday Project At The Shack® Near You

DC Circuits Books and Audio Course



DC Circuits
Basic Electricity and DC Circuits

DC Circuits Volume I
Basic Electricity and Circuit Concepts

DC Circuits Audio Learning Package

29⁹⁵ **6⁹⁵ Each** **Both Books for 10⁸⁸**

Save \$3⁰²

Developed for Radio Shack by Texas Instruments Learning Center

- A** DC Circuits Volume I. Introduction to electricity, voltage, Ohm's law, parallel circuits and more. Fully illustrated. 460 pages. 62-2019 6.95
- B** DC Circuits Volume II. Voltage dividers, capacitors, inductors and more. Illustrated. 508 pages. 62-2020 6.95
- C** DC Circuits Audio Learning Package. Six standard cassettes for use with Volumes I and II above. 62-2401 29.95

D to A Converter

4⁴⁹
NEW!



16-Pin With Data

DAC801. Produces varying output voltages up to 20V p-p with 8-bit input. Works with all logic families. 276-1791 4.49

A to D Converter

2⁵⁹
NEW!



8-Pin With Data

TL507. Converts analog processes to digital signals—up to 1000 operations per second. I²L technology. 276-1789 2.59

Semiconductor Reference Guide




2⁹⁹
NEW!

1982 Edition. Complete data on Shack® ICs and discrete devices, plus over 82,000 substitution listings. 276-4005 2.99

V to F, F to V IC

14-Pin With Data



NEW!

Ideal for Modems And Tone Decoders **3⁴⁹**

9400. Converts input voltage to proportional frequency or vice versa. Linearity: 0.05%. Works up to 100 kHz. Single or dual supply. 276-1790 3.49

SPST Switch With LED Indicator



Rated 5 Amps! 2⁹⁹

- LED in Handle Glows When "On"
- Ideal for Use in Vehicles

Heavy-duty toggle requires a 7/16" mounting hole. 12VDC use only. 275-680 2.99

Magnet Wire

Set of 3 Spools **4⁴⁹**



Ideal for coils and chokes. 40 ft. of 22-gauge, 75 ft. of 26-ga., 200 ft. of 30-ga. 278-1345 3-Spool Set/4.49

Wiring Aids

A **2¹⁹** **B** **1⁶⁹**



Set of 2 Set of 10

A Spiral Wrap. Neatly bundles wiring. 5 ft. clear, 5 ft. black. 278-1638 Set, 2.19

B Universal Cable Clip. Accepts wire up to 1/2" dia. Self adhesive. 278-1639 Set of 10, 1.69

10.7 MHz IF Filter



NEW! **1⁹⁹**

Pkg. of 2

Full-Spec Device!

SFE10.7MA5-A. For updating FM IFs, CB to 10-meter FM conversions, more. In/out Z: 330 ohms. Bandwidth: 280 KHz at 3 dB down points. 272-1301 Pkg. 2/1.99

100k-Ω Joystick



For Video Games, RC Vehicles and Microcomputers

4⁹⁵

Two linear taper controls with one removable 1"-long shaft. 271-1705 4.95

Micro Test Clips

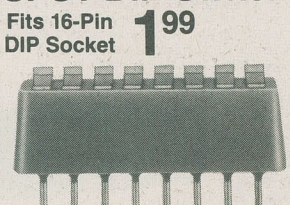


NEW! **1⁴⁹** Pkg. of 2

Spring-action, 1 1/2"-long. Ideal for testing on high-density boards. One red, one black. 270-370 Set, 1.49

SPST DIP Switch

Fits 16-Pin DIP Socket **1⁹⁹**



8-Position. For digital or low-current uses. 275-1301 1.99

Mini 12VDC Buzzer



With Leads **1⁶⁹**

Small enough to hide, loud enough to get attention! 1 1/16" mtg. centers. 273-055 1.69

"Designer" Box



NEW!

Slots Inside for Two 4 3/4x2" PC Boards **7⁹⁵**

Modern two-tone styling, easy-to-work end panels. 2 1/4x5x5 1/4". 270-218 7.95

Direct-Etch Transfers



NEW! **2⁴⁹** Set

With Instructions

Just rub circles, strips, and pads onto PC board and you're ready to etch! Set of four sheets. 276-1577 Set, 2.49

Quiet AC Fan



15⁹⁵

- Diecast Venturi
- Delivers Up To 70 CFM

Ideal for power supplies, computers, Ham rigs. 4 3/8x4 3/8x1 1/2". 273-241 15.95

Tri-Color LED



1³⁹

Ideal Status Indicator!

Glow red on DC, green on reverse DC, yellow on AC! T-1 3/4 size. 2.2V at 25 milliamps. 276-035 1.39

Retail prices may vary at individual stores and dealers

Season's Greetings to All of You From All of Us at Radio Shack!

Radio Shack®

A DIVISION OF TANDY CORPORATION • FORT WORTH, TEXAS 76102
OVER 8000 LOCATIONS IN 53 COUNTRIES

CIRCLE 7 ON FREE INFORMATION CARD

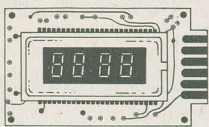
7400

SN7400N	.19	SN74123N	.59
SN7401N	.22	SN74125N	.39
SN7402N	.22	SN74126N	.44
SN7403N	.22	SN74128N	.59
SN7404N	.22	SN74132N	.69
SN7405N	.23	SN74136N	.75
SN7406N	.23	SN74139N	.95
SN7407N	.23	SN74141N	.79
SN7408N	.26	SN74142N	2.95
SN7409N	.23	SN74143N	2.95
SN7410N	.22	SN74144N	2.95
SN7411N	.22	SN74145N	.62
SN7412N	.29	SN74147N	1.95
SN7413N	.39	SN74148N	1.20
SN7414N	.59	SN74150N	1.09
SN7416N	.29	SN74152N	.67
SN7417N	.29	SN74153N	.67
SN7420N	.22	SN74154N	1.19
SN7421N	.35	SN74155N	.78
SN7422N	.29	SN74156N	.78
SN7423N	.29	SN74157N	.69
SN7425N	.29	SN74158N	1.65
SN7426N	.29	SN74160N	.88
SN7427N	.25	SN74161N	.88
SN7428N	.45	SN74162N	.89
SN7430N	.23	SN74163N	.87
SN7432N	.29	SN74164N	.87
SN7437N	.25	SN74165N	.87
SN7438N	.29	SN74166N	1.20
SN7439N	.29	SN74167N	.89
SN7440N	.19	SN74168N	1.69
SN7441N	.79	SN74170N	.89
SN7442N	.57	SN74172N	4.75
SN7443N	.95	SN74173N	.79
SN7444N	.95	SN74174N	.89
SN7445N	.79	SN74175N	.85
SN7446N	.79	SN74176N	1.19
SN7447N	.65	SN74177N	.75
SN7448N	.79	SN74179N	1.34
SN7450N	.19	SN74180N	.75
SN7451N	.19	SN74181N	1.75
SN7452N	.19	SN74182N	.75
SN7454N	.19	SN74184N	2.25
SN7455N	.25	SN74185N	2.25
SN7456N	.23	SN74186N	3.95
SN7457N	.29	SN74187N	3.95
SN7458N	.29	SN74188N	1.15
SN7459N	.34	SN74189N	1.15
SN7460N	.34	SN74190N	.85
SN7461N	.38	SN74191N	.85
SN7462N	.38	SN74192N	.85
SN7463N	.38	SN74193N	.85
SN7464N	.38	SN74194N	.85
SN7465N	.38	SN74195N	.85
SN7466N	.38	SN74196N	.85
SN7467N	.38	SN74197N	.85
SN7468N	.38	SN74198N	1.39
SN7469N	.38	SN74199N	1.39
SN7470N	.38	SN74200N	1.19
SN7471N	.38	SN74201N	1.19
SN7472N	.38	SN74202N	1.19
SN7473N	.38	SN74203N	1.19
SN7474N	.38	SN74204N	1.19
SN7475N	.38	SN74205N	1.19
SN7476N	.38	SN74206N	1.19
SN7477N	.38	SN74207N	1.19
SN7478N	.38	SN74208N	1.19
SN7479N	.38	SN74209N	1.19
SN7480N	.38	SN74210N	1.19
SN7481N	.38	SN74211N	1.19
SN7482N	.38	SN74212N	1.19
SN7483N	.38	SN74213N	1.19
SN7484N	.38	SN74214N	1.19
SN7485N	.38	SN74215N	1.19
SN7486N	.38	SN74216N	1.19
SN7487N	.38	SN74217N	1.19
SN7488N	.38	SN74218N	1.19
SN7489N	.38	SN74219N	1.19
SN7490N	.38	SN74220N	1.19
SN7491N	.38	SN74221N	1.19
SN7492N	.38	SN74222N	1.19
SN7493N	.38	SN74223N	1.19
SN7494N	.38	SN74224N	1.19
SN7495N	.38	SN74225N	1.19
SN7496N	.38	SN74226N	1.19
SN7497N	.38	SN74227N	1.19
SN7498N	.38	SN74228N	1.19
SN7499N	.38	SN74229N	1.19
SN7500N	.38	SN74230N	1.19

74LS00

74LS00N	.26	74LS184N	1.19
74LS01N	.26	74LS185N	.89
74LS02N	.26	74LS186N	2.48
74LS03N	.26	74LS187N	1.15
74LS04N	.35	74LS188N	1.15
74LS05N	.35	74LS189N	1.15
74LS06N	.35	74LS190N	1.99
74LS07N	.35	74LS191N	.89
74LS08N	.35	74LS192N	.89
74LS09N	.35	74LS193N	.89
74LS10N	.35	74LS194N	1.15
74LS11N	.39	74LS195N	.95
74LS12N	.39	74LS196N	.95
74LS13N	.47	74LS197N	.95
74LS14N	.55	74LS198N	.95
74LS15N	.33	74LS199N	.95
74LS16N	.33	74LS200N	.95
74LS17N	.33	74LS201N	.95
74LS18N	.33	74LS202N	.95
74LS19N	.33	74LS203N	.95
74LS20N	.33	74LS204N	.95
74LS21N	.33	74LS205N	.95
74LS22N	.33	74LS206N	.95
74LS23N	.33	74LS207N	.95
74LS24N	.33	74LS208N	.95
74LS25N	.33	74LS209N	.95
74LS26N	.33	74LS210N	.95
74LS27N	.33	74LS211N	.95
74LS28N	.33	74LS212N	.95
74LS29N	.33	74LS213N	.95
74LS30N	.33	74LS214N	.95
74LS31N	.33	74LS215N	.95
74LS32N	.33	74LS216N	.95
74LS33N	.33	74LS217N	.95
74LS34N	.33	74LS218N	.95
74LS35N	.33	74LS219N	.95
74LS36N	.33	74LS220N	.95
74LS37N	.33	74LS221N	.95
74LS38N	.33	74LS222N	.95
74LS39N	.33	74LS223N	.95
74LS40N	.33	74LS224N	.95
74LS41N	.33	74LS225N	.95
74LS42N	.33	74LS226N	.95
74LS43N	.33	74LS227N	.95
74LS44N	.33	74LS228N	.95
74LS45N	.33	74LS229N	.95
74LS46N	.33	74LS230N	.95
74LS47N	.33	74LS231N	.95
74LS48N	.33	74LS232N	.95
74LS49N	.33	74LS233N	.95
74LS50N	.33	74LS234N	.95
74LS51N	.33	74LS235N	.95
74LS52N	.33	74LS236N	.95
74LS53N	.33	74LS237N	.95
74LS54N	.33	74LS238N	.95
74LS55N	.33	74LS239N	.95
74LS56N	.33	74LS240N	.95
74LS57N	.33	74LS241N	.95
74LS58N	.33	74LS242N	.95
74LS59N	.33	74LS243N	.95
74LS60N	.33	74LS244N	.95
74LS61N	.33	74LS245N	.95
74LS62N	.33	74LS246N	.95
74LS63N	.33	74LS247N	.95
74LS64N	.33	74LS248N	.95
74LS65N	.33	74LS249N	.95
74LS66N	.33	74LS250N	.95
74LS67N	.33	74LS251N	.95
74LS68N	.33	74LS252N	.95
74LS69N	.33	74LS253N	.95
74LS70N	.33	74LS254N	.95
74LS71N	.33	74LS255N	.95
74LS72N	.33	74LS256N	.95
74LS73N	.33	74LS257N	.95
74LS74N	.33	74LS258N	.95
74LS75N	.33	74LS259N	.95
74LS76N	.33	74LS260N	.95
74LS77N	.33	74LS261N	.95
74LS78N	.33	74LS262N	.95
74LS79N	.33	74LS263N	.95
74LS80N	.33	74LS264N	.95
74LS81N	.33	74LS265N	.95
74LS82N	.33	74LS266N	.95
74LS83N	.33	74LS267N	.95
74LS84N	.33	74LS268N	.95
74LS85N	.33	74LS269N	.95
74LS86N	.33	74LS270N	.95
74LS87N	.33	74LS271N	.95
74LS88N	.33	74LS272N	.95
74LS89N	.33	74LS273N	.95
74LS90N	.33	74LS274N	.95
74LS91N	.33	74LS275N	.95
74LS92N	.33	74LS276N	.95
74LS93N	.33	74LS277N	.95
74LS94N	.33	74LS278N	.95
74LS95N	.33	74LS279N	.95
74LS96N	.33	74LS280N	.95
74LS97N	.33	74LS281N	.95
74LS98N	.33	74LS282N	.95
74LS99N	.33	74LS283N	.95
7500N	.38	74LS284N	.95
7501N	.38	74LS285N	.95
7502N	.38	74LS286N	.95
7503N	.38	74LS287N	.95
7504N	.38	74LS288N	.95
7505N	.38	74LS289N	.95
7506N	.38	74LS290N	.95
7507N	.38	74LS291N	.95
7508N	.38	74LS292N	.95
7509N	.38	74LS293N	.95
7510N	.38	74LS294N	.95
7511N	.38	74LS295N	.95
7512N	.38	74LS296N	.95
7513N	.38	74LS297N	.95
7514N	.38	74LS298N	.95
7515N	.38	74LS299N	.95
7516N	.38	74LS300N	.95
7517N	.38	74LS301N	.95
7518N	.38	74LS302N	.95
7519N	.38	74LS303N	.95
7520N	.38	74LS304N	.95
7521N	.38	74LS305N	.95
7522N	.38	74LS306N	.95
7523N	.38	74LS307N	.95
7524N	.38	74LS308N	.95
7525N	.38	74LS309N	.95
7526N	.38	74LS310N	.95
7527N	.38	74LS311N	.95
7528N	.38	74LS312N	.95
7529N	.38	74LS313N	.95
7530N	.38	74LS314N	.95
7531N	.38	74LS315N	.95
7532N	.38	74LS316N	.95
7533N	.38	74LS317N	.95
7534N	.38	74LS318N	.95
7535N	.38	74LS319N	.95
7536N	.38	74LS320N	.95
7537N	.38	74LS321N	.95
7538N	.38	74LS322N	.95
7539N	.38	74LS323N	.95
7540N	.38	74LS324N	.95
7541N	.38	74LS325N	.95
7542N	.38	74LS326N	.95
7543N	.38	74LS327N	.95
7544N	.38	74LS328N	.95
7545N	.38	74LS329N	.95
7546N	.38	74LS330N	.95
7547N	.38	74LS331N	.95
7548N	.38	74LS332N	.95
7549N	.38	74LS333N	.95
7550N	.38	74LS334N	.95
7551N	.38	74LS335N	.95
7552N	.38	74LS336N	.95
7553N	.38	74LS337N	.95
7554N	.38	74LS338N	.95
7555N	.38	74LS339N	.95
7556N	.38	74LS340N	.95
7557N	.38	74LS341N	.95
7558N	.38	74LS342N	.95
7559N	.38	74LS343N	.95
7560N	.38	74LS344N	.95
7561N	.38	74LS345N	.95
7562N	.38	74LS346N	.95
7563N	.38	74LS347N	.95
7564N	.38	74LS348N	.95
7565N	.38	74LS349N	.95
7566N	.38	74LS350N	.95
7567N	.38	74LS351N	.95
7568N	.38	74LS352N	.95
7569N	.38	74LS353N	.95
7570N	.38	74LS354N	.95
7571N	.38	74LS355N	.95
7572N	.38	74LS356N	.95
7573N	.38	74LS357N	.95
7574N	.38	74LS358N	.95
7575N	.38	74LS359N	.95
7576N	.38	74LS360N	.95
7577N	.38	74LS361N	.95
7578N	.38	74LS362N	.95
7579N	.38	74LS363N	.95
7580N	.38	74LS364N	.95
7581N	.38	74LS365N	.95
7582N	.38	74LS366N	.95
7583N	.38	74LS367N	.95
7584N	.38	74LS368N	.95
7585N	.38	74LS369N	.95
7586N	.38	74LS370N	.95
7587N	.38	74LS371N	.95
7588N	.38	74LS372N	.95
7589N	.38	74LS373N	.95
7590N	.38	74LS374N	.95
7591N	.38	74LS375N	.95
7592N	.38	74LS376N	.95
7593N	.38	74LS377N	.95
7594N	.38	74LS378N	.95
7595N	.38	74LS379N	.95
7596N	.38	74LS380N	.95
7597N	.38	74LS381N	.95
7598N	.38	74LS382N	.95
7599N	.38	74LS383N	.95
7600N	.38	74LS384N	.95
7601N	.38	74LS385N	.

National Semiconductor Clock Modules



12VDC AUTOMOTIVE/INSTRUMENT CLOCK

- APPLICATIONS:
- In-dash auto clocks
 - After-market auto/ RV clocks
 - Aircraft marine clocks
 - 12VDC oper. instrum.
 - Portable/battery powered instrumts.

Features: Bright 0.3" green display. Internal crystal time-base. ±0.5 sec./day accur. Auto display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete—just add switches and lens.

MA1003 Module (3.05" Lx1.75" Hx.98" D) . \$16.95

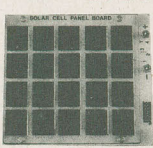
CLOCK MODULES

MA1023 .7" Red Digital LED Clock Module	8.95
MA1026 .7" Dig. LED Alarm Clock/Thermometer	18.95
MA5036 .3" Red Digital LED Clock/Timer	6.95
MA1002 .5" Red Digital LED Clock & Xformer	9.95
MA1010 .8" Red Digital LED Clock	7.95
MA1032 CBA .5" Digital LCD Clock	17.95
MA1043 .7" Green Digital LED Clock	8.95

102-P22 Xformer for MA1023, 1043 & 5036 Models	3.49
102-P22 Xformer for MA1026 Clock Modules	3.49
102-P24 Xformer for MA1010 Clock Modules	3.49



Sun Power Your Electronics! SOLAR CELL PANEL KIT



- Features:
- Output: 10VDC, to 100mA in Series 5VDC, to 200mA in Parallel
 - Panel may be easily connected for Series or Parallel out
 - Over 11 square inches of active cell surface
 - Voltage line tap @ 0.5V increments
 - Provision for charging batteries
 - Overall panel size: 4 1/4" L x 4 1/4" W x 1/8" D

The JE305 Solar Cell Panel Kit contains 20 solar cells. On the panel board are power line taps which allow the user to select voltages (one voltage at a time) from 0.5VDC to 10VDC. The applications of each panel can be further expanded by coupling additional panels in series for more voltage or in parallel for more current. The premium grade solar cells provide the current necessary for the operation of most portable transistor radio, auto battery powered cassette tape players and unlimited experimental solar projects.

JE305 \$39.95

EPROM Erasing Lamp

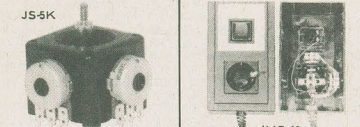


- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact—only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11E Replacement Bulb \$16.95

UVS-11E \$79.95

JOYSTICKS



JS-5K	5K Linear Taper Pots	\$5.25
JS-100K	100K Linear Taper Pots	\$4.95
JVC-40	40K (2) Video Controller in case	\$4.95

ALLIGATOR CLIP TEST LEADS



Heavy-duty leads, color coded. Insulated alligator clip on each end. 15" long. Two each black, red, blue, white and yellow.

#ALCP (10 per pack) \$2.95/pkg.

NEW! JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

- FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
 - Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 15VDC @ 500mA, and 12VDC @ 175mA.
 - Two, 3-terminal adj. IC regulators with thermal overload protection.
 - Heat sink regulator cooling.
 - LED "on" indicator.
 - Printed Board Construction
 - 120VAC input
 - Size: 3-1/2" W x 5-1/16" L x 2-1/8" H

JE215 Adj. Dual Power Supply Kit (as shown)	\$24.95
(Picture not shown but similar in construction to above)	
JE200 Reg. Power Supply Kit (5VDC, 1 amp)	\$14.95
JE205 Adapter Bdy. Kit (JE200) ±5.2V & ±12V	\$12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp	\$19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A CPU	4.95
DP8212 8-Bit Input/Output	3.25
DP8214 Priority Interrupt Control	5.95
DP8216 Bi-Directional Buffer	2.95
DP8224 Clock Generator/Driver	3.95
DP8226 Bus Driver	3.49
DP8228 System Controller/Bus Driver	3.49
DP8238 System Controller	5.95
INS8243 I/O Expander for 48 Series	10.95
INS8250 Asynchronous Comm. Element	9.95
DP8251 Prog. Comm. I/O (USART)	6.95
DP8253 Prog. Interval Timer	8.95
DP8255 Prog. Peripheral I/O (PPI)	5.95
DP8257 Prog. DMA Control	9.95
DP8259 Prog. Interrupt Control	9.95
DP8276 Prog. CRT Controller	39.95
DP8279 Prog. Keyboard/Display Interface	9.95
DP8303 System Timing Element	6.95
DP8304 8-Bit Bi-Directional Receiver	3.95
DP8307 8-Bit Bi-Directional Receiver	3.95
DP8308 8-Bit Bi-Directional Receiver	3.95
DP8310 Octal Latched Peripheral Driver	5.25
DP8311 Octal Latched Peripheral Driver	5.25

6800/6800A SUPPORT DEVICES

MC6800 CPU with Clock and RAM	14.95
MC6801 128K Static RAM	4.95
MC6802 Peripheral Inter. Adapt. (MC6820)	7.49
MC6803 Priority Interrupt Controller	17.95
MC6803L8 1024x8-Bit ROM (MC68030-8)	14.95
MC6850 Asynchronous Comm. Adapter	6.95
MC6852 Synchronous Serial Data Adapter	6.95
MC6860 4000bps Digital MODEM	10.95
MC6862 2400bps Modulator	12.95
MC6880A Quad 8-Bit Shift. Trans. (MC6876)	2.25

MICROPROCESSOR CHIPS

Z80 (780C) CPU (MK3800N) (2MHz)	11.95
Z80A (780-1) CPU (MK3800N-4) (4MHz)	13.95
CDP1802 MPU	16.95
IMC2901 ADC CPU—4-Bit Slice (Com. Temp. Grade)	19.95
MC6550 MPU—4-Bit Slice (80K Bytes Memory)	11.95
INS8035N-4 MPU—4-Bit (60Hz)	7.95
INS8039N-4 CPU—Sgl. Chip 8-Bit (128bytes RAM)	9.95
INS8040N-4 CPU (26 Bytes RAM)	24.95
INS8070N CPU—64 Bytes RAM	24.95
INS8073N CPU w/Basic Micro Interpreter	29.95
PM05 CPU—16-Bit	39.95
TM5990JUL CPU—16-Bit	39.95

SHIFT REGISTERS

MM500H Dual 25-Bit Dynamic	.50
MM503H Dual 50-Bit Dynamic	.50
MM506H Dual 100-Bit Dynamic	.50
MM510H Dual 64-Bit Accumulator	.50
MM1402N 256-Bit Dynamic	2.95
MM5033H 1024-Bit Dynamic/Accumulator	1.95
MM5036H 500/512-Bit Dynamic	1.95
MM5034N Octal 80-Bit	9.95
MM5035H Octal 80-Bit	9.95
MM5036H 256V (HMA) 1024-Bit Dynamic	1.95
2518N Hex 32-Bit Static	2.95
2522V Dual 132-Bit Static	2.95
2524V Dual 132-Bit Dynamic	.99
2525V Dual 104-Bit Dynamic	.99
2527V Dual 256-Bit Static	2.95
2528V Dual 256-Bit Static	4.00
2529V Dual 256-Bit Static	4.00
2532N Quad 60-Bit Static	2.95
3813PC F16 (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN Universal Active Filter L/S	5.95
AF121-1CJ Touch Tone Low Band Filter	19.95
AF122-1CJ Touch Tone High Band Filter	19.95
LM338C-1 Super Gain Op. Amp	1.95
LM338Z Constant Current Source	1.30
LM338Z Temperature Transducer	1.40
LF388N JFET Input Op. Amp	1.10
LF388N Sample & Hold Amplifiers	3.95
LM3991 Temp. Comp. Prec. Ref. (5ppm/C)	5.00
ADC0804LCN 8-Bit A/D Converter (1 LSB)	4.95
ADC0804LCN 8-Bit D/A Converter (0.8% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0808C 8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN 8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1001LCN 10-Bit D/A Conv. Micro. Comp. (0.05% Lin.)	13.95
DAC1001LCN 10-Bit D/A Conv. Micro. Comp. (0.20% Lin.)	8.95
DAC1001LCN 10-Bit D/A Converter (0.05% Lin.)	8.49
DAC1001LCN 10-Bit D/A Converter (0.20% Lin.)	1.95
DAC1001LCN 10-Bit D/A Converter (0.20% Lin.)	1.95
CM0401N 4-Channel Multiplexer	1.10
AY-5103 30K BAUD UART	6.95

RAM'S

1101 256K Static	1.40
1103 1024K Dynamic	.99
2101 (401) 256K Static	.99
2103 1024K Static	1.75
2102 1024K Static	1.50
2111 (411) 256K Static	3.95
2112 256K Static MOS	3.95
2114 1024K Static 40ns Low Power	4.49
2114L-2 1024K Static 20ns Low Power	4.95
745200 256K Static	6.95
416N4 (UPD416) 16K Dynamic 250ns (MM5290N-4)	2.95
416N4 64K Dynamic 200ns	2.49
MM5217J 4096K1 Fast 70ns	7.95
5101 256K Static	.99
MM5291 1024K Dynamic Fully Decoded	.99
MM5292 2Kx1 Dynamic	.99
MM5293 4096K1 Dynamic	4.95
MM5294-2 (4116) 16K Dynamic 16ns (UPD416C-3)	4.95
MM5295-3A 8K Dyn. 200ns (lower of MM5290)	1.95
HM61164 16K (2Kx8) Static 200ns	4.95
82525 64-Bit RAM (8040C)	2.49
UPD4164 (MK4027) 4K Dynamic 16-pin	4.95
TM5404-45NLC 4K Static	9.95
MM5405 16K Static	9.95

PROMS/EPROMS

2K EPROM Erasable PROM	5.95
8K EPROM	4.95
16K EPROM (45V, +5V, +12V)	7.49
TM5275 16K EPROM (Single +5V)	8.95
2732Intel TI 32K EPROM	17.95
2758 8K EPROM (40ns) (Single +5V)	7.49
2764 64K EPROM (Hitachi HM62764)	49.95
2804 PROM	14.95
82513 (74S183) 32x8 PROM (Open Collector)	3.95
82513 32x8 PROM (Open Collector)	3.95
82513 32x8 PROM (Open Collector)	3.95
82513 32x8 PROM (Open Collector)	3.95
82513 32x8 PROM (Open Collector)	3.95

ROM'S

25132201 Character Generator (Upper Case)	9.95
25132201 Character Generator (Lower Case)	9.95
MM5291 1024K Dynamic Fully Decoded	.99
MM5292 2Kx1 Dynamic	.99
MM5293 4096K1 Dynamic	4.95
MM5294-2 (4116) 16K Dynamic 16ns (UPD416C-3)	4.95
MM5295-3A 8K Dyn. 200ns (lower of MM5290)	1.95
HM61164 16K (2Kx8) Static 200ns	4.95
82525 64-Bit RAM (8040C)	2.49
UPD4164 (MK4027) 4K Dynamic 16-pin	4.95
TM5404-45NLC 4K Static	9.95
MM5405 16K Static	9.95

MICROPROCESSOR MANUALS

M-280 User Manual	7.50
M-280 User Manual	7.50
M-280 User Manual	7.50

SPECIAL FUNCTION

DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50
DS90C03CN Dual MOS Clock Driver (5Mz)	3.50

RADIO CONTROL CIRCUITS

LM1871N R.C. Encoder/Transmitter Chip	\$5.49
A complete 5-channel dig. encoder and R.T. transmitter, low power, at freq. of 27MHz or 49MHz; a lead strength of 10,000V/meter at 3 meters; 30V operation on chip RF oscillator/transmitter; on chip 4.5V reg. Up to 80MHz carrier freq. operation	
LM1872N R.C. Receiver/Decoder Chip	\$5.49
A complete R.F. receiver/decoder; used at either 27, 49 or 72MHz; It provides 4 independent channels within used w/ LM1871 (2 analog, 2 dig.) operates from 4.5V cts. Crystal oscillator; 30V operation	
SRX1505 48.890MHz Crystal (LM1872N)	\$4.95
SRX1505 48.890MHz Crystal (LM1871N)	\$4.95

JE608 PROGRAMMER 2704/2708 EPROM PROGRAMMER

GENERAL APPLICATIONS:

- To program EPROMS 2704 and 2708.
- Developmental system for microcomputer circuits.
- To read the contents of a pre-programmed EPROM.
- To compare EPROMs for content differences.
- To emulate a programmed EPROM.
- To store program in RAMS for alterations.
- Three separate Display Registers: 8 LEDs for Hex key entries, 10 LEDs (2-2) for Address Register and 8 LEDs for Data Memory Register. The Data Memory Register displays the content of the RAMS from the EPROM Chip. Development of microprocessor systems by means of a ribbon cable from the programmer panel leads to the EPROM chip.
- Read checking verification of programmed data changes. User may move data from master to RAM or write into RAM's with keyboard entries. Allows manual stepping manipulation (up and down) at any address zero force insertion type. Power requirements: 115VAC, 60Hz, 6W. Compact desk-top enclosure. Color-coded ribbon cable with light tan panels and molded end pieces in mocha brown. Size: 3 1/4" H x 11 1/4" W x 8 1/4" D. Weight: 5 lbs.

The JE608 EPROM Programmer is a completely self-contained unit which is independent of computer control and requires no additional systems for its operations. The EPROM can be programmed from the Hexadecimal Keyboard or from a pre-programmed EPROM. The JE608 Programmer can emulate a programmed EPROM by the use of its internal RAM circuits. This will allow the user to test or pretest a program for a system, prior to programming a chip. Any changes in the program can be entered directly into the memory circuits with the Hexadecimal Keyboard so that rewriting the entire program will not be necessary. The JE608 Programmer contains a Programmer Board w/ 25 IC's & includes power supplies of: -5V, +5V, +12V and +20V. The Hexadecimal Keyboard and LED/TEST/Socket Panel are separate assemblies within the system.

JE608K Kit \$399.95

JE608A Assembled and Tested \$499.95

JE608-16K ADAPTER BOARD FOR 2716/2758 EPROMS

GENERAL DESCRIPTION:

The JE608-16K Adapter Board allows the JE608 Programmer to be modified for the additional programming of the 2716 and 2758 EPROMs. The adapter provides for adding an address switch for the 2716 bit and also for selecting proper power and timing pulses to be applied to the EPROM. Programming and emulating the 2716 (EPROM) is done separately to each half (1024bits) of the EPROM. The adapter also provides for the existing 8K RAM capacity in the JE608 Programmer.

JE608-16K Adapter Board Kit \$29.95

JE608-Upgrade (Send assembled JE608 to factory for adapter installation) \$99.95

JE608A-16K Mod. Assembled JE608 w/ Adapter (JE608-16K) Installed \$599.95

\$10.00 Min. Order — U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage—Add 5% plus \$1.50 Insurance

Spec Sheets — 25¢
Send 8¢ Postage for your
FREE 1982 JAMECO CATALOG

NEW 1982 CATALOG

MAIL ORDER ELECTRONICS — WORLDWIDE
1355 SHOREWAY ROAD, BELMONT, CA 94002
PRICES SUBJECT TO CHANGE
CIRCLE 4 ON FREE INFORMATION CARD

BOOKS

National Semiconductor — Intersil — Intel

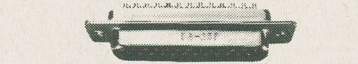
30001 National CMOS Data Book (840 pages) 74C, CD4000, and A/D Converters	\$6.95
30002 National Interface Data Book (704 pages) DP, DS8000, DS3600, DS7500, etc.	\$6.95
30003 National Linear Data Book (1376 pages) LM, LF, ADC, DAC, LH Series	\$4.95
30004 National Systems 80 — Board Level Computer (224 pages)	\$4.95
30005 National TTL Logic Data Book (624 pages) 7400, LS, L, H, S, and DM8000 Series	\$4.95
30006 Buy above (3) 30001-3, 5 as a set	\$19.95/lot
30009 Intersil Data Book (1074 pages)	\$6.95
010400 Intel Component Data Catalog (1074 pages)	\$10.00
205610 Intel Peripheral Design Handbook (644 pages)	\$7.50

AC and DC Wall Transformers



Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	\$3.95
AC 500	117V/60Hz	12 VAC 500mA	\$4.95
AC1000	117V/60Hz	12 VAC 1 amp	\$5.95
AC1700	117V/60Hz	9 VAC 1.7 amp	\$3.95
DC 9200	117V/60Hz	9 VDC 200mA	\$3.95
DC 9100	120V/60Hz	9 VDC 500mA	\$3.95

CONNECTORS



DB25P D-Subminiature Plug	\$2.95
DB25S D-Subminiature Socket	\$3.50
D20414-2 Screw Lock Hdw. (2) DB25P/ S	\$2.95
DB51226 Cover for DB25P/S	\$1.75
22/45E P.C. Edge (22/44 Pin)	\$2.95
UG88/U BNC Plug	\$1.79
UG89/U BNC Jack	\$3.79
UG175/U UHF Adapter	\$4.49
SO239 UHF Panel Recp.	\$1.29
PL258 UHF Adapter	\$1.60
PL259 UHF Plug	\$1.60
UG260/U BNC Plug	\$1.79
UG1094/U BNC Bulkhead Recp.	\$1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:

- 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
- *Memory for Conversion

TRS-16K2 *150NS \$29.95

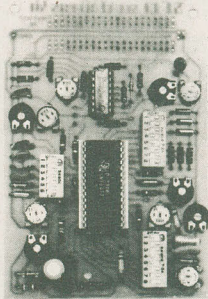
TRS-16K3 *200NS \$24.95

TRS-16K4 *250NS \$19.95

BULLET ELECTRONICS

P.O. BOX 401244R
GARLAND, TX. 75040
(214) 278-3553

Sound Effects Kit \$18.50



The SE-01 is a complete kit that contains all the parts to build a programmable sound effects generator. Designed around the new Texas Instruments SN76477 Sound Chip, the board provides banks of MINI DIP switches and pots to program the various combinations of the SLF Oscillator, VCO, Noise, One Shot, and Envelope Controls. A Quad Op Amp IC is used to implement an Adjustable Pulse Generator, Level Comparator and Multiplex Oscillator for even more versatility. The 3 1/4" x 5" PC Board features a prototype area to allow for user added circuitry. Easily programmed to duplicate Explosions, Phasor Guns, Steam Trains, or almost an infinite number of other sounds. The unit has a multiple of applications. The low price includes all parts,

assembly manual, programming charts, and detailed 76477 chip specifications. It runs on a 9V battery (not included). On board 100MW amp will drive a small speaker directly, or the unit can be connected to your stereo with incredible results! (Speaker not included). 76477 is included. Available separately for \$3.15 each.

AY3-8910 PROGRAMMABLE SOUND GENERATOR

The AY3-8910 is a 40 pin LSI chip with three oscillators, three amplitude controls, programmable noise generator, three mixers, an envelope generator, and three D/A converters that are controlled by 8 BIT WORDS. No external pots or caps required. This chip hooked to an 8 bit microprocessor chip or Buss (8080, Z80, 6800 etc.) can be software controlled to produce almost any sound. It will play three note chords, make bangs, whistles, sirens, gunshots, explosions, bleats, whines, or grunts. In addition, it has provisions to control its own memory chips with two IO ports. The chip requires +5V @ 75ma and a standard TTL clock oscillator. A truly incredible circuit.

\$12.95 W/Basic Spec Sheet (4 pages)
60 page manual with S-100 interface instructions and several programming examples, **\$3.00 extra**

MANY OTHER COMPONENTS AND KITS AVAILABLE
IN OUR COMPLETE CATALOG. CALL OR WRITE FOR
FREE CATALOG.

Doomsday Alarm Kit \$9.95

If you have trouble sleeping and you would like the rest of the neighborhood to share your misery then this little kit will be for you! There is no way to accurately describe the unearthly howls, screams and tones that come out of this kit. Four separate tone oscillators are mixed, cancelled and stepped at a varying rate. 10 Watts of crazy sounds. A great fun kit or a practical burglar alarm. Complete with PC board and all necessary components less speaker. For 6-12 VDC. ORDER DA-02.

Overvoltage Protection Kit \$6.95

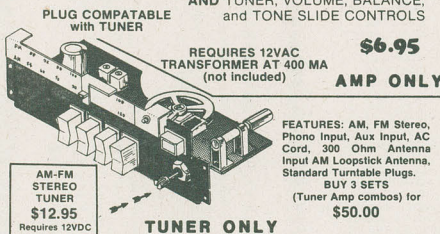
Protect your expensive equipment from overvoltage conditions. Every computer should have one! Works with any fused DC power source from 10 to 20 volts up to 25 amps.

7 Watt Audio Amp Kit \$5.95

SMALL, SINGLE HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

Stereo AMP/Power Supply Board

Takes low level audio and drives 8 ohm speakers ON-BOARD Rectifiers and Filter supply power for AMP AND TUNER, VOLUME, BALANCE, and TONE SLIDE CONTROLS



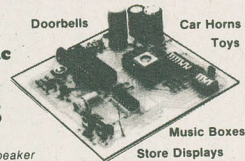
- * NO C.O.D.'s
- * SEND CHECK M.O. OR CHARGE CARD NO.
- * PHONE ORDERS ACCEPTED ON VISA AND MASTERCARD ONLY.
- * ADD 5% FOR SHIPPING
- * TX. RES. ADD 5% STATE SALES TAX
- * ALL FOREIGN ORDERS ADD 30% FOR SHIPPING CHARGES.
- * U. S. FUNDS ONLY.

The Greatest Breakthrough In Electronic Music Ever!

The Super Music Maker

REVISION 2
\$24.95
(Basic Kit)

Does not include speaker switches or 2708 ROM.



Now you can play hundreds of songs using the Bullet Super Music Maker. The unit features a single factory programmed microprocessor IC that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to 1000 notes per PROM. Just think... a compact electronic instrument that will play dozens, hundreds or even thousands of selections of music. The kit comes with all electronic components (less the PROM), and a drilled, plated and screened PC Board which measures 4" x 4 1/4". The 7 watt amplifier section is on the same PC board and drives an 8 ohm speaker (not included), from a whisper to ear splitting volume. Since the unit works on 12 VDC or 12 VAC*, vehicle or portable operation is possible. What do you get for \$24.95? Everything but a speaker, transformer, case, switches, and PROM. Additional 2708 albums containing popular tunes are available for \$15.00 each or you can program your own PROMS using information provided with the kit instructions. Lists of available PROM albums are available on request. (Note: Unit plays electronic music one note at a time, it is not possible to play chords or a melody with harmony simultaneously.)

- * Envelope control gives decay to notes.
- * "Next tune" feature allows sequential playing of all songs.
- * On board inverter allows single voltage (+12) operation.

OPTIONAL ACCESSORIES

- DIP Switches One 8 pos., One 5 pos. 2.00/Set
(Can be directly soldered to PC Bd. to access tunes)
- Rotary Switches Two 5 position 2.50/Set
(For remote wiring to PC Bd. to access tunes)
- Attractive Plastic Case 6.50
- Wallplug Transformer 3.00
(For operation on 117VAC house voltage)

PMC PERSONAL COMPUTER

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.



EG3000 Series

WITH
NEW
EXTRA
KEYS!

ONLY
\$575
POSTAGE
\$20

- 16K user RAM plus extended 12K Microsoft BASIC in ROM • Fully TRS-80 Level II software compatible • Huge range of software already available • Self contained, PSU, UHF modulator, and cassette • Simply plugs into video monitor or UHF TV • Full expansion to disks and printer • Absolutely complete — just fit into mains plug.



SHARP PC1211

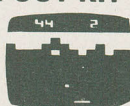
\$190

COMPUTER
POWER THAT
ONCE FILLED A ROOM
CAN NOW BE CARRIED IN YOUR POCKET!

- Programs in BASIC • "QWERTY" Alphabetic Keyboard • 1.9K Random Access Memory • Long Battery Life.

TV GAME BREAK OUT KIT

Has got to be one of the world's greatest TV games. You really get hooked. Has also 4 other pinball games and lots of options. Good kit for up-grading old amusement games.



MINI KIT PCB, sound & vision modulator, memory chip and de code chip. Very simple to construct **\$30.00**
OR PCB \$6.00 MAIN LSI \$17.00

TTL SALE

74LS00	\$0.15	74LS74	\$0.45	74LS365	\$0.75
75LS04	\$0.15	74LS86	\$0.55	74LS373	\$2.20
74LS05	\$0.20	74LS93	\$0.90	Z80A	\$5.50
74LS10	\$0.29	74LS157	\$1.20	Z80	\$4.20
74LS32	\$0.35	74LS165	\$1.75	REG. 7805	\$0.90

SOCKETS LOW PROFILE

14 PIN \$0.10	18 PIN \$0.15	24 PIN \$0.25
16 PIN \$0.10	20 PIN \$0.15	40 PIN \$0.30
10V Power Adapter 600ml.	\$6.90	UHF Modulators \$9.90

GET YOURSELF A NEW EPSON MX80 & MX70 PRINTER AND SAVE A FORTUNE

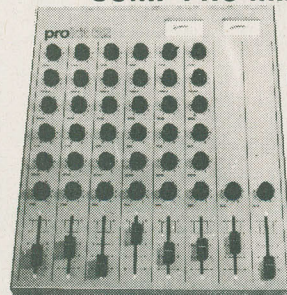
Price on application

Interface Cards for Apple, Pet, TRS80, and PMC — RS232 Interface Cards not necessary for parallel.

Full TRS80



COMP PRO MIXER



Professional audio mixer that you can build yourself and save over \$200.

Only **\$199** for complete kit.

power supply \$50.00

POSTAGE \$20

ACCESSIT AUDIO ADD-ONS

LOOK! MICROACE/SINCLAIR USERS

8K FLOATING POINT SUPER ROM PACK

WITH NEW MANUAL ONLY **\$35**

MICROACE/SINCLAIR VIDEO UPGRADE KIT

Only runs with NEW ROM (Smooth screen display) ONLY **\$29**

MICROACE/SINCLAIR 16K RAM PLUS EXPANSION BOARD

3 SLOTS WITH EXTRA POWER SUPPLY

16K ONLY **\$149**

4K ONLY **\$110**



MicroAce A COMPLETE COMPUTER

A new generation of miniature computers

2K Kit ONLY **\$149**

Post and Packing FREE

Sinclair is a Registered Trademark of Sinclair Research Ltd.

MicroAce



Please make checks and money orders payable to **MicroAce** or phone your order quoting **Master Charge, Visa, Diners Club or American Express** number for immediate despatch. Add 6% Tax for Shipments inside California. **MicroAce**, 1348 East Edinger, Santa Ana, California, Zip Code 92705. Telephone: (714) 547 2526

ramsey

the first name in Counters!



9 DIGITS 600 MHz \$129⁹⁵ WIRED

PRICES:
CT-90 wired, 1 year warranty \$129.95
CT-90 Kit, 90 day parts warranty 109.95
AC-1 AC adapter 3.95
BP-1 Nicad pack + AC Adapter/Charger 12.95
OV-1, Micro-power Oven time base 49.95
External time base input 14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

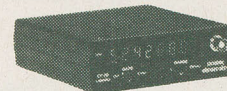
Range: 20 Hz to 600 MHz
Sensitivity: Less than 10 MV to 150 MHz
Less than 50 MV to 500 MHz
Resolution: 0.1 Hz (10 MHz range)
1.0 Hz (60 MHz range)
10.0 Hz (600 MHz range)
Display: 9 digits 0.4" LED
Time base: Standard 10,000 mHz, 1.0 ppm 20-40°C.
Optional Micro-power oven 0.1 ppm 20-40°C
Power: 8-15 VAC @ 250 ma

7 DIGITS 525 MHz \$99⁹⁵ WIRED

SPECIFICATIONS:

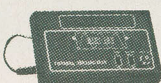
Range: 20 Hz to 525 MHz
Sensitivity: Less than 50 MV to 150 MHz
Less than 150 MV to 500 MHz
Resolution: 1.0 Hz (5 MHz range)
10.0 Hz (50 MHz range)
100.0 Hz (500 MHz range)
Display: 7 digits 0.4" LED
Time base: 1.0 ppm TCXO 20-40°C
Power: 12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.



PRICES:

CT-70 wired, 1 year warranty \$99.95
CT-70 Kit, 90 day parts warranty 84.95
AC-1 AC adapter 3.95
BP-1 Nicad pack + AC adapter/charger 12.95



7 DIGITS 500 MHz \$79⁹⁵ WIRED

PRICES:

MINI-100 wired, 1 year warranty \$79.95
AC-Z AC adapter for MINI-100 3.95
BP-Z Nicad pack and AC adapter/charger 12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range: 1 MHz to 500 MHz
Sensitivity: Less than 25 MV
Resolution: 100 Hz (slow gate)
1.0 KHz (fast gate)
Display: 7 digits, 0.4" LED
Time base: 2.0 ppm 20-40°C
Power: 5 VDC @ 200 ma

8 DIGITS 600 MHz \$159⁹⁵ WIRED

NEW
READ
FREQUENCY

SPECIFICATIONS:

Range: 20 Hz to 600 MHz
Sensitivity: Less than 25 mv to 150 MHz
Less than 150 mv to 600 MHz
Resolution: 1.0 Hz (60 MHz range)
10.0 Hz (600 MHz range)
Display: 8 digits 0.4" LED
Time base: 2.0 ppm 20-40°C
Power: 110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!



PRICES:

CT-50 wired, 1 year warranty \$159.95
CT-50 Kit, 90 day parts warranty 119.95
RA-1, receiver adapter kit 14.95
RA-1 wired and pre-programmed (send copy of receiver schematic) 29.95



DIGITAL MULTIMETER \$99⁹⁵ WIRED

PRICES:

DM-700 wired, 1 year warranty \$99.95
DM-700 Kit, 90 day parts warranty 79.95
AC-1, AC adaptor 3.95
BP-3, Nicad pack + AC adapter/charger 19.95
MP-1, Probe kit 2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts: 100uV to 1 KV, 5 ranges
DC/AC current: 0.1uA to 2.0 Amps, 5 ranges
Resistance: 0.1 ohms to 20 Megohms, 6 ranges
Input impedance: 10 Megohms, DC/AC volts
Accuracy: 0.1% basic DC volts
Power: 4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug. \$ 7.95
High impedance probe, light loading 15.95
Low pass probe, for audio measurements 15.95
Direct probe, general purpose usage 12.95
Tilt bail, for CT 70, 90, MINI-100 3.95
Color burst calibration unit, calibrates counter against color TV signal. 14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

ramsey electronics, inc.

2575 BAIRD RD. • PENFIELD, NY 14526

PHONE ORDERS
CALL 716-586-3950

TERMS

Satisfaction guaranteed - examine for 10 days, if not pleased, return in original form for refund. Add 5% for shipping + insurance to a maximum of \$10. Overseas add 15%. COD add \$2. Orders under \$10, add \$1.50. NY residents, add 7% tax.

CIRCLE 8 ON FREE INFORMATION CARD

DECEMBER 1981

131

FUJITECH AUDIO KITS

LATEST AUDIO TECHNOLOGY FROM JAPAN

Model A501 Power Amp

- Pure Class A 25W + 25W
- Switchable to Class AB 100W + 100W
- Switchable to Bridge Class A 100W mono
- Switchable to Bridge Class AB 300W mono
- Frequency Response 5-200KHz (-1dB)
- Signal-to-Noise Ratio 120dB
- Non-magnetic Chassis
- "Out-board" comprehensive protection circuitry
- DC circuitry with limited use of NFB
- High Efficiency Fluid Convection Cooling
- THD under 0.007%

KIT ONLY
\$299.00

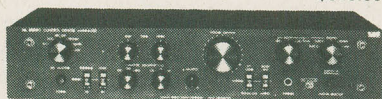


\$299.00

Model A502 DC Stereo Control Center

- Direct DC coupling from Input to Output
- DC servo circuitry
- Cascade FET Input in all stages
- Separate Moving Coil RIAA amplifier
- Distortion below 0.005% (3V)
- Max Output 15V
- Frequency Response 20Hz-20KHz ± 0.2 dB
- Maximum Phono Input
 - MC = 16mv RMS (1KHz)
 - MM = 270mv RMS (1KHz)
- Built-in Headphone amplifier
- Relay Output Muting

KIT ONLY
\$349.00

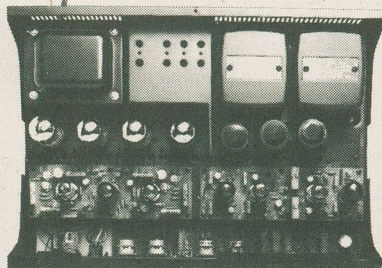


\$349.00

Model A1033 Integrated Tube Amplifier

- Latest Japanese Design
- Distortionless Output Transformer using special winding techniques
- Most circuitry on PCB for easy assembly and humfree performance
- Output 30W x 2 Ultra Linear
 - (Switchable to Triode)
 - 15W x 2 Triode Output
 - (near class A performance)
- THD under 0.4%
- Frequency Response 30~30,000 Hz (-1dB)
- Separate Pre-Out and Main-In

KIT ONLY
\$499.00



\$499.00

Send \$5.00 for each assembly manual, refundable with order.

Monarchy Engineering, Inc.
380 Swift Avenue, Unit 21
South San Francisco, CA 94080

Visa or Mastercharge acceptable.

FREE CATALOG

OF Burglar/Fire Alarms



With over 1600 hard to get security products for home, business and industry, **Mountain West** is a one-stop supermarket for professional alarm installers as well as do-it-yourselfers. Systems and parts range from simple, quickly installed units to the most sophisticated electronic equipment. 68 pages are filled with pictures, diagrams and instructions.

Mail to: **Mountain West**
4215 N. 16th St.
Box 10780 Dept RE-12
Phoenix, Az. 85064

YES, I want a FREE CATALOG.

My name is _____

I live at _____

In _____ State _____ Zip _____

or call **TOLL-FREE**
(800)528-6169

CIRCLE 44 ON FREE INFORMATION CARD

ELECTRONIC KITS FROM HAL-TRONIX

2304 MHZ DOWN CONVERTERS. TUNES IN ON CHANNELS 2 TO 7 ON YOUR OWN HOME T.V. HAS FREQUENCY RANGE FROM 2000 MHZ TO 2500 MHZ. EASY TO CONSTRUCT AND COMES COMPLETE WITH ALL PARTS INCLUDING A DIE-CAST ALUM CASE AND COAX FITTINGS, REQUIRE A VARIABLE POWER SUPPLY AND ANTENNA (Antenna can be a dish type or coffee can type depending on the signal strength in your area.)

2304 MOD 1 (Basic Kit) \$49.95

(Less case & fittings)

2304 MOD 2 (Basic / Pre-amp) \$59.95

(Includes case & fittings)

2304 MOD 3 (Hi-Gain Pre-amp) \$69.95

(Includes case & fittings)

POWER SUPPLY FOR EITHER MODEL ABOVE IS AVAILABLE. COMES COMPLETE WITH ALL PARTS, CASE, TRANSFORMER, ANTENNA SWITCH AND CONNECTORS (Kit) \$24.95

Assembled.....\$34.95

Slotted Microwave Antenna For Above

Downverters.....\$39.95

PREAMPLIFIERS

HAL PA-19—1.5 mhz to 150 mhz. 19db gain operates on 8 to 18 volts at 10ma. Complete unit \$8.95.

HAL PA-14—3 mhz to 1.4 ghz. 10 to 12 db gain operates on 8 to 18 volts at 10ma. Complete unit \$12.95.

(The above units are ideal for receivers, counters, etc.)

16 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS\$69.95

12 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS\$39.95

16 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS\$39.95

12 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS\$29.95

MANY, MANY OTHER KITS AVAILABLE

Send 15¢ stamp or S.A.S.E. for information and flyer on other HAL-TRONIX products. To order by phone, 1-313-285-1782.



HAL-TRONIX

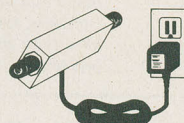
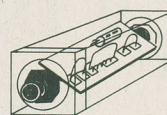
P.O. Box 1101

Southgate, MI 48195

SHIPPING INFORMATION:
ORDERS OVER \$20.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN \$20.00 PLEASE INCLUDE ADDITIONAL \$1.50 FOR HANDLING AND MAILING CHARGES.

CIRCLE 36 ON FREE INFORMATION CARD

SIMPLE SIMON KITS



ZYZZX
VHF-UHF WIDEBAND
ANTENNA AMPLIFIER
MODEL ALL-1
50 MHz — 900 MHz
12 dB GAIN ± 0.5 dB

SIMPLE SIMON ELECTRONICS INTRODUCES

A REVOLUTIONARY NEW ONE STAGE HYBRID IC BROADBAND AMPLIFIER

This unit is not available anywhere else in the world. One unit serves many purposes and is available in Kit or Assembled form. Ideal for outdoor or indoor use. Input-output impedance is 75 ohms. Amplifier includes separate co-ax feed power supply. Easily assembled in 25 minutes. No coils, capacitors etc. to tune or adjust.

ALL-1 Complete Kit plus Power Supply \$24.95

ALL-1 Assembled / Tested plus Power Supply \$34.95

7 + 11 PARTS KITS

MITSUBI

VARACTOR

UHF TUNER

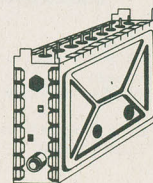
Model UES-A56F

\$34.95

Freq. Range UHF470 - 889MHz

Antenna Input 75 ohms

Channels 14-83 Output Channel 3



KIT NO	PART NO	DESCRIPTION	PRICE
1	VT1-SW	Varactor UHF Tuner, Model UES-A56F	\$34.95
2	CB1-SW	Printed Circuit Board, Pre-Drilled	18.95
3	TP7-SW	P.C.B. Potentiometers, 1-20K, 1-1K, and 5-10K ohms, 7-pieces	5.95
4	FR35-SW	Resistor Kit, 1/4 Watt, 5% Carbon Film, 32-pieces	4.95
5	PT1-SW	Power Transformer, PRI-117VAC, SEC-24VAC, 250ma	6.95
6	PP2-SW	Panel Mount Potentiometers and Knobs, 1-1KBT and 1-5KAT w/Switch	5.95
7	SS14-SW	IC's 7-pcs, Diodes 4-pcs, Regulators 2-pcs Heat Sink 1-piece	29.95
8	CE9-SW	Electrolytic Capacitor Kit, 9-pieces	5.95
9	CC33-SW	Ceramic Disk Capacitor Kit, 50 W.V., 33-pieces	7.95
10	CT-SW	Variable Ceramic Trimmer Capacitor Kit, 5-65pfd, 6-pieces	5.95
11	L4-SW	Coil Kit, 18mhz 2-pieces, 22kzhs 1-piece (prewound inductors) and 1 T37-12 Ferrite Torroid Core with 3 ft. of #26 wire	5.00
12	ICS-SW	I.C. Sockets, Tin inlay, 8-pin 5-pieces and 14-pin 2-pieces	1.95
13	SR-SW	Speaker, 4x6" Oval and Prewound Wood Enclosure	14.95
14	MISC-SW	Misc. Parts Kit Includes Hardware (6/32, 8/32 Nuts, & Bolts), Hookup Wire, Ant. Terms, DPDT Ant. Switch, Fuse, Fuseholder, etc.	9.95
When Ordering All Items, (1 thru 14), Total Price			\$139.95

ANTENNAS & ACCESSORIES

STVA-1STV	Yagi Antenna, 13.5 dB, 75 ohm, Chan. 42-54	\$9.95
STVA-2-STV	Yagi Antenna, 13.5 dB, 75 ohm, Chan. 20-28	9.95
CX-75 Coaxial 75 ohm Low Loss Ant. Cable		\$.12 P/FT.
F-59 Coaxial Connectors ea		\$.39
MT-1 Special UHF 75-300 OHM Matching Transformer ea		\$1.45
ALL-1 Indoor/Outdoor HYBRID IC Wideband VHF-UHF-FM 75 OHM Antenna Amplifier Kit		\$24.95
Assembled		\$34.95

Mail Order Only — Send Check or Money Order To:
SIMPLE SIMON ELECTRONIC KITS

Calif. Orders:
3871 S. Valley View, Suite 12, Las Vegas, Nevada 89103

Tel: (702) 322-5273

All Other Orders:

11850 S. Hawthorne Blvd., Hawthorne, Calif. 90250

Tel: (213) 675-3347

Minimum Order: \$19.95. Add 10% Shipping and Handling.

For Orders over \$40.00, Add 5% Catalog \$1.00.

— VISA and Mastercard Acceptable —

Look before you reap.

There are many good ways to make your money work for you. And some not so good. So don't leap into anything without taking a long, hard look. Especially if you have no savings in reserve.

And if you don't have enough savings, look into U.S. Savings Bonds. Because Bonds do make sense.

They guarantee the interest. They're guaranteed against loss, fire, and theft. And the Payroll Savings Plan is a sure, easy way to guarantee savings. Federal income tax may be deferred and there's no state or local income tax.

A little is set aside each payday for U.S. Savings Bonds. Your savings will grow until you're ready to reap the rewards of regular saving.

Saving is one of the most important financial decisions you'll ever make.

**Take
stock
in America.**

When you put part of your savings into U.S. Savings Bonds you're helping to build a brighter future for your country and for yourself.

Ad Council A public service of this publication and The Advertising Council.

Call
615-244-4444

JAVANCO

150 2nd Ave. South
Nashville, TN 37201

YOUR PARTS SUPERMARKET

ORDER #

REV-I REVERBERATOR COILS (MAKE THOSE SPEAKERS LINGER) INPUT 1 OHM OUTPUT HI-Z CASE DIM: 11 x 4 1/4 x 1 1/4 SPRINGS AND ALL, TYPICAL DIAGRAM FINISHED W/PURCHASE ONLY \$12.00 EA. PS-40 POWER SUPPLY 12V 1.5 A REGULATED RCA IN CASE COMPLETE \$12.00 EA. SPECIAL PURCHASE TANTALUM CAPACITOR (Look to us for better buys all time)

TC-41 47/6.3v Dip PC leads	.35¢ ea.
TC-40 10/16 v Dip PC leads	.25¢ ea.
TC-45 68/16 V Dip PC leads	\$1.90 ea.
TC-16 3.3/16 V Dip PC leads	.22¢ ea.
TC-29 15/20 v Plastic A	.22¢ ea.
TC-30 15/20 V Solid axial	.50¢ ea.
TC-36 33/25 V Dip PC leads	\$1.50 ea.
TC-39 10/25 V Dip PC	.50¢ ea.
TC-37 .22/35 V PC Dip	.18¢ ea.
TC-38 .47/35 V PC Dip	.18¢ ea.
TC-42 2.2/35 V PC Dip	.21¢ ea.
TC-15 4.7/35 V PC Dip	.22¢ ea.
TC-43 15/35 V PC Dip	\$1.70 ea.
TC-44 22/25 V PC Dip	\$1.50 ea.
TC-35 18/50 V Solid axi	\$2.50 ea.
TC-1 47/35 V Solid axi	\$1.50 ea.

TO GET ON MAIL
LIST CIRCLE READER #
OR WRITE, THANKS.



IN MUSIC CITY
WE'LL FIDDLE WITH
PRICES ON QUANTITY

WRITE US

ASSORTED KITS: **TELL US WHAT
ORDER # YA WANT**

DCK-100 (100) PC LD. Discaps assortment	\$1.90
LTK-25 (25) PC insulated terminal lugs	\$1.40
TRK33-K3 (3) PC 75 W 10 Amp to-220 case	
75 Watt 10 Amp (Gooder N, Most) (3) Pcs	\$1.25
CLK-20 Coil kit (20) Open wind coils asst	\$1.40
PRK-20 (20) Good value ww resistors	\$1.40
LEDK-12 (12) Asst shapes, sizes, colors (12)	\$1.50
LED12-K9 (9) Super bright red LED's (9)	.80
SPRK-20 Spring kit asst. (20) springs	.85
SDK-10 Signal diode kit (10) pc's asst.	.65
DIK-25 Diode asst. rect., Zener, signal	\$1.00
ZDK-1 Zener diode kit (10) 1/2 & 1 W	\$2.00
KNK-20 Knob kit asst. (20) No junkers	\$2.20
ECK-50 Electrolytic kit asst. (50) pcs.	\$3.60

WE DON'T SEND OUT BANJO'ED PARTS

WE UN'S AT MUSIC CITY WARRANTY ALL THESE THANGS WER' OFFERING YA. Y'ALL KIN SEND UM BAC IF Y'ALL DON'T LIKE UM WE'LL SWAP SUM MORE. WE WILL EVEN GIVE YOU A FULL REFUND LESS FREIGHT FOR ANY REASON YOU WISH TO RETURN THEM WITHIN 30 DAYS FROM INVOICE DATE.

HSK-100 (100) inches asst., sizes heat shrink tubing	\$1.35
FH-1 Inline fuse holder (dual cord 50"W/3 amp fuse (3)	\$1.25
SA-24 Heres a whistler, clapper, slapper, voicer board complete board w/mike attached w/diagram	\$1.90
RY-55 Relay can be added for additional switching	.29 TOO CHEEP
IC-144 Int cir. 74C903 hex inverter	.90
IC-20 Int cir. 4011 B we'uns dun sold out twice gitum	.17 NO ERROR
IC-148 NE555 (5)	\$1.00
HP-5 Box to hook to yore speakers then plug a stereo thing in it from yore stereo headphones and listen to it	\$2.00

TRA-120 Transistor #AC172 NPN metal case to-1 ger.(1)	.45
TRA-119 Transistor 2SB54 PNP to-1 germanium transistor (1)	.35
TRA-118 Transistor 2SB364 PNP to-1 germanium matched (1)	.40
EC44K-3 1000 mfd. 25 volt axial leads (3) Lytics (3)	\$1.00
CP-98 capacitor .1 @ 2000 V got screw on ends (pretty)	\$1.30
FP-51 6800 mfd. 50 volts insulated can capacitor (1)	\$1.00
TR-120 62 volts center tapped at 8 amp	\$12.00 ea.

WE SHORE WILL LIKE TO DO BIZNES WITH Y'ALL WE'LL TRY HARD TO KEEP ON GIVING OUT GOODER PRICES ALL TIMES WE CAN.

WE DON'T BELIEVE MANY FOLKS GOT NO MORE PARTS N WE GOTIN STOCK AND WE SHORE WANT TO GIT SHED OF SUM OF UM.

SOME ITEMS MAY BE LIMITED IN QUANTITY
ADD \$2.50 TOTAL FOR SHIPPING ALL ORDERS

JAVAN ENTERPRISES, INC., 150 SECOND AVE. SOUTH, NASHVILLE, TN. 37201
TOLL FREE ORDER LINE 800-251-8130 TO PLACE ORDERS
(VISA AND MASTER CHARGE ACCEPTED)
TENN. RESIDENTS ADD 6.75% SALES TAX. TENN. 615-244-4444

TO ORDER TOLL FREE 1-800-251-8130
INFORMATION & CONVERSATION CALL 615-244-4444

**OLE J
SEZ
WE GOT TO
SHED SUM
INVENTORY,
THANKS.**

*Javan
Happy Holiday*

**WE
GOT
A
ZILLION
MORE
THANGS**

CIRCLE 26 ON FREE INFORMATION CARD

DECEMBER 1981

16K Memory

4116-200ns

8/17.50

ALL MERCHANDISE 100% GUARANTEED!

CALL US FOR VOLUME QUOTES

JDR MICRODEVICES, INC IS PROUD TO
ANNOUNCE THE OPENING OF OUR
NEW RETAIL SHOWROOM

**BAY AREA RESIDENTS
STOP BY 1224 BASCOM AVE.**

LS SERIES

74LS00	25	74LS164	.95
74LS01	25	74LS165	.95
74LS02	25	74LS166	2.40
74LS03	25	74LS168	1.75
74LS04	25	74LS169	1.75
74LS05	25	74LS170	1.75
74LS08	35	74LS173	.80
74LS09	25	74LS174	.95
74LS10	25	74LS175	.95
74LS11	35	74LS181	2.15
74LS12	35	74LS189	9.95
74LS13	45	74LS190	1.00
74LS14	1.00	74LS191	1.00
74LS15	35	74LS192	.85
74LS20	25	74LS193	.95
74LS21	35	74LS194	1.00
74LS22	25	74LS195	.95
74LS26	35	74LS196	.85
74LS27	35	74LS197	.85
74LS28	35	74LS221	1.20
74LS30	25	74LS240	1.85
74LS32	35	74LS241	1.85
74LS33	55	74LS242	1.85
74LS37	55	74LS243	1.85
74LS38	35	74LS244	1.75
74LS40	25	74LS245	2.85
74LS42	55	74LS247	.70
74LS47	75	74LS248	1.85
74LS48	75	74LS249	.99
74LS49	75	74LS251	1.30
74LS51	25	74LS253	.85
74LS54	35	74LS257	.85
74LS55	35	74LS258	.85
74LS63	1.25	74LS259	2.85
74LS73	40	74LS260	1.85
74LS74	45	74LS266	.55
74LS75	50	74LS273	1.65
74LS76	40	74LS275	3.35
74LS78	50	74LS279	.55
74LS83	75	74LS280	1.98
74LS85	1.15	74LS283	1.00
74LS86	40	74LS290	1.25
74LS90	65	74LS293	1.85
74LS91	89	74LS295	1.05
74LS92	70	74LS298	1.20
74LS93	65	74LS324	1.75
74LS95	85	74LS352	1.55
74LS96	95	74LS353	1.55
74LS107	40	74LS363	1.35
74LS109	40	74LS364	1.35
74LS112	45	74LS365	.95
74LS113	45	74LS366	.95
74LS114	50	74LS367	.70
74LS122	45	74LS368	.70
74LS123	95	74LS373	1.85
74LS124	2.89	74LS374	1.80
74LS125	95	74LS377	1.85
74LS126	85	74LS378	1.18
74LS132	75	74LS379	1.35
74LS136	55	74LS385	1.90
74LS137	99	74LS386	.65
74LS138	75	74LS390	1.90
74LS139	75	74LS393	1.90
74LS145	1.20	74LS395	1.65
74LS147	2.49	74LS399	1.70
74LS148	1.35	74LS447	.37
74LS151	75	74LS490	1.95
74LS153	75	74LS568	1.69
74LS154	2.35	74LS569	1.89
74LS155	1.15	74LS570	2.20
74LS156	95	74LS574	9.95
74LS157	75	74LS582	2.30
74LS158	75	74LS583	2.30
74LS160	90	74LS584	2.40
74LS161	95	74LS585	2.40
74LS162	95	74LS588	2.40
74LS163	95	74LS589	2.40

8200

8202	45.00
8205	3.50
8212	1.95
8214	3.90
8216	1.85
8224	2.50
8226	1.85
8228	4.95
8237	19.95
8238	4.95
8243	4.50
8250	14.95
8251	5.50
8253	9.85
8253-5	9.85
8255	5.25
8255-5	5.25
8257	9.00
8259	7.00
8272	39.95
8275	29.95
8279	10.50
8279-5	10.50
8282	6.65
8283	6.65
8284	5.80
8286	6.65
8287	6.65
8288	25.00
8289	49.95

MPU'S

8035	16.95
8039	19.95
8080A	3.95
8085	12.95
8086	99.95
8088	39.95
8155	11.95
8156	11.95
8185	29.95
8185-2	39.95
8741	39.95
8748	69.95
8755	49.95

Z80

Z80	8.95
Z80A	9.95
Z80B	19.95
Z80-PIO	6.50
Z80A-PIO	8.60
Z80-CTC	6.50
Z80A-CTC	8.65
Z80-DART	15.25
Z80A-DART	18.75
Z80-DMA	17.50
Z80A-DMA	27.50
Z80-SIO/0	23.95
Z80A-SIO/0	28.95
Z80-SIO/1	23.95
Z80A-SIO/1	28.95
Z80-SIO/2	23.95
Z80A-SIO/2	28.95
Z80-SIO/9	17.95
Z80A-SIO/9	22.95

MISC.

8T26	1.69	3242	9.95
8T28	2.49	AY5-1013	3.95
8T95	.99	TR1602	4.95
8T96	.99	IM6402	7.95
8T97	.99	1771	24.95
8T96	.99	1791	36.95
1488	.99	1793	49.95
1489	.99	UPD765	39.95
DM8131	2.95	8272	39.95
14411	9.95	74C923	5.95

MA1012A CLOCK MODULE

- 1/2" RED LED CHARACTERS
- 12-HOUR FORMAT
- FACTORY ASSEMBLED
- JUST ADD SWITCHES
- COMPLETE WITH SPECIAL TRANSFORMER AND SPECS.

\$8⁹⁹ ea. 3/\$24⁰⁰

TRANSISTORS

PN2222	10/1.00	100/8.99
2N3904	10/1.00	100/8.99
2N3906	10/1.00	100/8.99
2N3055	.79	10/6.99
IN4148		25/1.00
IN4004		10/1.00

6502

6502	6.95
6502A	12.95
6504	6.95
6505	8.95
6520	4.95
6522	9.95
6532	14.95
6551	14.95

CALL JDR BEFORE YOU BUY!
WE WILL BEAT ANY COMPETITORS PRICES.

800-538-5000 800-662-6233

(CALIFORNIA RESIDENTS)

EPROMS

			8pcs
1702	256 x 8 (1us)	4.95	4.50
2708	1024 x 8 (450ns)	3.95	3.50
2758	1024 x 8 (450ns)(5v)	9.95	8.95
TMS2516	2048 x 8 (450ns)(5v)	7.95	6.95
2716	2048 x 8 (450ns)(5v)	5.95	5.50
2716-1	2048 x 8 (350ns)(5v)	12.95	11.95
TMS2716	2048 x 8 (450ns)	9.95	8.95
TMS2532	4096 x 8 (450ns)(5v)	19.95	17.95
2732	4096 x 8 (450ns)(5v)	16.50	15.95

STATIC RAMS

			100pcs
2101	256 x 4 (450ns)	1.95	1.85
2102-1	1024 x 1 (450ns)	.89	.85
21L02-1	1024 x 1 (450ns)(LP)	1.29	1.15
2111	256 x 4 (450ns)	2.99	2.49
2112	256 x 4 (450ns)	2.99	2.79
2114	1024 x 4 (450ns)	8/17.95	2.10
2114L-2	1024 x 4 (200ns)(LP)	8/22.95	2.45
2114L-3	1024 x 4 (300ns)(LP)	8/21.95	2.45
2114L-4	1024 x 4 (450ns)(LP)	8/18.95	2.25
TMS4044-4	4096 x 1 (450ns)	3.49	3.25
TMS4044-3	4096 x 1 (300ns)	3.99	3.75
TMM2016	2048 x 8 (200ns)	CALL	
HMS1116	2048 x 8 (200ns)	CALL	

DYNAMIC RAMS

			100pcs
4027	4096 x 1 (250ns)	2.50	2.00
4116-150	16,384 x 1 (150ns)	8/19.95	2.35
4116-200	16,384 x 1 (200ns)	8/17.50	1.95
4116-300	16,384 x 1 (300ns)	8/16.95	1.85
4164	65,536 x 1 (200ns)	CALL	

LP=LOW POWER

DIP SWITCHES

4 position	.85
5 position	.90
6 position	.90
7 position	.95
8 position	.95

CONNECTORS

RS232 MALE	3.25
RS232 FEMALE	3.75
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95

LEDS

Jumbo Red	10/1.00
Jumbo Green	6/1.00
Jumbo Yellow	6/1.00
5082-7760 .43"CC	.79
MAN74 .3"CC	.99
MAN72 .3"CA	.99

IC SOCKETS

	1-100	100pcs
8 pin ST	.13	.11
14 pin ST	.15	.12
16 pin ST	.17	.13
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39

ST = SOLDERTAIL		
8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80

WW = WIREWRAP

VOLTAGE REG'S

7905T	.89	7905T	.99
7908T	.99	7912T	.99
7812T	.89	7915T	1.19
7815T	.99	7924T	1.19
7824T	.99		
7905K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	7915K	.79
78105	.69	79112	.79
78112	.69	79115	.79
78115	.69	LM317K	3.95
LM309K	1.49	LM323K	4.95
LM317T	1.95	LM337K	3.95

T=TO-220 K=TO-3 L=TO-92

LINEAR

LM301V	.34	LM741V	.29
LM308V	.98	LM747	.79
LM309K	1.49	LM748V	.59
LM311	.64	LM1310	2.90
LM317T	1.95	MC1330V	1.89
LM317K	3.95	MC1350V	1.29
LM318	1.49	MC1358	1.79
LM323K	4.95	LM1414	1.59
LM324	.69	LM1458V	.69
LM337K	3.95	LM1488	.99
LM339	.99	LM1489	.99
LM377	2.29	LM1800	2.99
LM380	1.29	LM1889	2.49
LM386V	1.50	LM3900	.59
LM555V	.39	LM3909V	.39
LM556	.69	LM3914	3.95
LM555	.99	LM3915	3.95
LM566V	1.49	LM3916	3.95
LM567V	1.29	75451V	.39
LM723	.49	75452V	.39
LM733	.98	75453V	.39

T=TO-220 V=8 PIN K=TO-3

JDR MICRODEVICES, INC.

1224 So. Bascom Ave.
San Jose, CA 95128

800-538-5000 • 800-662-6233 (Calif.)
408-247-4852

New
Location



VISA®

2716 EPROMS 450NS (5V)

8/5.50 ea.

ALL MERCHANDISE 100% GUARANTEED!

CALL US FOR VOLUME QUOTES

CMOS

74C00	.35	74C374	2.75	4019	.45	4098	2.49
74C02	.35	74C901	.80	4020	.95	4099	1.95
74C04	.35	74C902	.85	4021	.95	14409	8.95
74C08	.35	74C903	.85	4022	1.15	14410	8.95
74C10	.35	74C905	10.95	4023	.35	14411	9.95
74C14	1.50	74C906	.95	4024	.75	14412	12.95
74C20	.35	74C907	1.00	4025	.35	14419	2.95
74C30	.35	74C908	2.00	4026	1.65	4502	.95
74C32	.50	74C909	2.75	4027	.65	4503	.65
74C42	1.75	74C910	9.95	4028	.80	4508	1.95
74C48	2.10	74C911	10.00	4029	.95	4510	.95
74C73	.65	74C912	10.00	4030	.45	4511	.95
74C74	.85	74C914	1.95	4034	2.95	4512	.95
74C76	.80	74C915	2.00	4035	.85	4514	1.25
74C83	1.95	74C918	2.75	4040	.95	4515	2.25
74C85	1.95	74C920	17.95	4041	1.25	4516	1.55
74C86	.95	74C921	15.95	4042	.75	4518	1.25
74C89	4.50	74C922	5.95	4043	.85	4519	1.25
74C90	1.75	74C923	5.95	4044	.85	4520	1.25
74C93	1.75	74C925	6.75	4046	.95	4522	1.25
74C95	1.75	74C926	7.95	4047	.95	4526	1.25
74C107	1.00	74C927	7.95	4049	.55	4527	1.95
74C150	5.75	74C928	7.95	4050	.55	4528	1.25
74C151	2.25	74C929	19.95	4051	.95	4531	.95
74C154	3.25	74C930	19.95	4053	.95	4532	1.95
74C157	1.75	4000	.35	4060	1.45	4538	1.95
74C160	2.00	4001	.35	4066	.75	4539	1.95
74C161	2.00	4002	.25	4068	.40	4543	2.70
74C162	2.00	4006	.95	4069	.35	4555	.95
74C163	2.00	4007	.29	4070	.35	4556	.95
74C164	2.00	4008	.95	4071	.30	4581	1.95
74C165	2.00	4009	.45	4072	.30	4582	1.95
74C173	2.00	4010	.45	4073	.30	4584	.95
74C174	2.25	4011	.35	4075	.30	4585	.95
74C175	2.25	4012	.25	4076	.95	4702	12.95
74C192	2.25	4013	.45	4078	.30	4724	1.50
74C193	2.25	4014	.95	4081	.30	80C07	.95
74C195	2.25	4015	.95	4082	.30	80C95	.85
74C200	5.75	4016	.45	4085	.95	80C96	.95
74C221	2.25	4017	1.15	4086	.95	80C97	.95
74C373	2.75	4018	.95	4093	.95	80C98	1.20

7400 SERIES

7400	.19	74128	.55
7401	.19	74132	.45
7402	.19	74136	.50
7403	.19	74141	.65
7404	.19	74142	2.95
7405	.22	74143	2.95
7406	.22	74144	2.95
7407	.22	74145	.60
7408	.24	74147	1.75
7409	.19	74148	1.20
7410	.19	74150	1.35
7411	.25	74151	.65
7412	.30	74152	.65
7413	.35	74153	.55
7414	.55	74154	1.40
7415	.25	74155	.75
7417	.25	74156	.65
7420	.19	74157	.55
7421	.35	74159	1.65
7422	.29	74160	.85
7423	.29	74161	.70
7425	.29	74162	.85
7426	.29	74163	.85
7427	.29	74164	.85
7428	.45	74165	.85
7430	.19	74166	1.00
7432	.29	74167	1.95
7433	.45	74170	1.65
7437	.29	74172	5.95
7438	.29	74173	.75
7440	.19	74174	.89
7442	.49	74175	.89
7443	.65	74176	.89
7444	.69	74177	.75
7445	.69	74178	1.15
7446	.59	74179	1.75
7447	.69	74180	.75
7448	.69	74181	2.25
7450	.19	74182	.75
7451	.23	74184	2.00
7453	.23	74185	2.00
7454	.23	74186	18.50
7460	.23	74190	1.15
7464	.39	74191	1.15
7465	.39	74192	.79
7470	.35	74193	.79
7472	.29	74194	.85
7473	.34	74195	.85
7474	.35	74196	.79
7475	.49	74197	.75
7476	.35	74198	1.35
7480	.59	74199	1.35
7481	1.10	74221	1.35
7482	.95	74246	1.35
7483	.50	74247	1.25
7484	.50	74248	1.85
7485	.65	74249	1.95
7486	.35	74251	.75
7489	4.95	74259	2.25
7490	.35	74265	1.35
7491	.40	74273	1.95
7492	.50	74276	1.25
7493	.49	74279	.75
7494	.65	74283	2.00
7495	.55	74284	3.75
7496	.70	74285	3.75
7497	2.75	74290	.95
74100	1.00	74293	.75
74107	.30	74298	.85
74109	.45	74351	2.25
74110	.45	74365	.65
74111	.55	74366	.65
74116	1.55	74367	.65
74120	1.20	74368	.65
74121	.29	74376	2.20
74122	.45	74390	1.75
74123	.55	74393	1.35
74125	.45	74425	3.15
74126	.45	74426	.85
		74490	2.55

NEED FAST PARTS?

DYNAMIC RAMS

4116	150NS	16K x 1	8/19.95
4116	120NS	16K x 1	8/29.95

STATIC RAMS

2147	55NS	4K x 1	9.95
6116	150NS	2K x 8	CALL
6116	120NS	2K x 8	CALL

EPROMS

2716-1	350NS	2K x 8	12.95
2732A	250NS	4K x 8	25.95
2732A-2	200NS	4K x 8	32.95

MPU's

Z-80B	CPU	6mHz	19.95
Z-80B	CTC	6mHz	17.95
Z-80B	PIO	6mHz	17.95
68B00	CPU	2mHz	10.95
68B21	PIA	2mHz	12.95
68B50	ACIA	2mHz	12.95
8085A-2	CPU	5mHz	16.95

74S00 SERIES

74S00	.44	74S74	.69	74S163	3.75	74S258	1.49
74S02	.48	74S85	2.39	74S168	4.65	74S260	1.83
74S03	.48	74S86	1.44	74S169	5.44	74S274	19.95
74S04	.79	74S112	1.59	74S174	1.09	74S275	19.95
74S05	.79	74S113	1.98	74S175	1.09	74S280	2.90
74S08	.48	74S114	1.50	74S181	4.47	74S287	4.75
74S09	.98	74S124	2.77	74S182	2.95	74S288	4.45
74S10	.69	74S132	1.24	74S188	3.95	74S289	6.98
74S11	.88	74S133	.98	74S189	14.95	74S301	6.95
74S15	.70	74S134	.69	74S194	2.95	74S373	3.45
74S20	.68	74S135	1.48	74S195	1.89	74S374	3.45
74S22	.98	74S138	1.08	74S196	4.90	74S381	7.95
74S30	.48	74S139	1.25	74S197	4.25	74S387	5.75
74S32	.98	74S140	1.45	74S201	14.95	74S412	2.98
74S37	1.87	74S151	1.19	74S225	8.95	74S471	9.95
74S38	1.68	74S153	1.19	74S240	3.98	74S472	16.85
74S40	.44	74S157	1.19	74S241	3.75	74S474	17.85
74S51	.78	74S158	1.45	74S251	1.90	74S482	15.60
74S64	.79	74S161	2.85	74S253	7.45	74S570	7.80
74S65	1.25	74S162	3.70	74S257	1.39	74S571	7.80

PROMS

74S188	(82S23)	OC	32 x 8	3.95
74S287	(82S129)	TS	256 x 4	4.75
74S288	(82S123)	TS	32 x 8	4.45
74S387	(82S126)	OC	256 x 4	5.75
74S471		TS	256 x 8	9.95
74S472	(82S147)	TS	512 x 8	16.85
74S474	(82S141)	TS	512 x 8	17.85
74S570	(82S130)	OC	512 x 4	7.80
74S571	(82S131)	TS	512 x 4	7.80

APPLE OWNERS EXPAND YOUR 48K COMPUTER TO 64K SUPER RAM • II

- PLUG IN SLOT 0
- GOLD PLATED CONTACTS
- INCLUDES 5 JUMPER OPTIONS
- INCLUDES 5 RAM-ROM OPTIONS
- ENJOY THE BEST OF BOTH WORLDS
- 16K RAM (RANDOM ACCESS MEMORY)
- THIS IS SOPHISTICATED FIRMWARE
- EXPANDS YOUR 48K APPLE TO 64K OF PROGRAMMABLE MEMORY
- ELIMINATES THE NEED FOR APPLE'S *OR INTEGER BASIC ROM CARD
- ALLOW YOU TO RUN APPLE'S NEW FORTRAN PACKAGE, ALSO PASCAL AND PILOT
- KEYBOARD CONTROL SELECTION OF RAM OR MOTHER BOARD ROM LANGUAGE
- INCLUDES INSTALLATION INSTRUCTIONS AND APPLICATIONS NOTES
- THE SOFTWARE DEVELOPED BY VARIOUS VENDORS FOR YOUR (64K) SHOULD NOW WORK AS THEY ADVERTISED
- THE MOST VERSATILE RAM EXPANSION ON THE MARKET TODAY

UNIQUE 1 YEAR WARRANTY! \$168.00

APPLE FAN

- "COOL-IT"
- TAN COLOR
- SAVE DOWN TIME
- LONG LIFE MOTOR
- LOW NOISE IS A MUST
- SAVE REPAIR CHARGES
- INCREASES RELIABILITY
- CLIPS ON—NO HOLES OR SCREWS
- MINIMUM QUIETNESS IS DUE TO THE DRAW EFFECT OF AIR THROUGH YOUR COMPUTER AND A SPECIAL FAN AND MOTOR DESIGN
- THOSE EXTRA PLUG-IN CARDS CAN CAUSE EXTRA HEAT

- HOW TO HOOK IT UP
1. Clip it on your APPLE
 2. Unplug your 120V cable (you won't need it)
 3. Plug short 120V cable from Super Fan II to the back of your computer
 4. Plug the supply cable from Super Fan II to your 120V power source
 5. Turn on the rocker switch and a built-in red ready light comes on
 6. You are all set "COOL IT"

UNIQUE 1 YEAR WARRANTY! \$69.00

*APPLE IS A TRADEMARK OF APPLE COMPUTER INC.



New Location

JDR MICRODEVICES, INC.

1224 So. Bascom Ave.
San Jose, CA 95128

800-538-5000 • 800-662-6233 (Calif.)
408-247-4852

TERMS: For shipping include \$2.00 for UPS Ground, \$3.00 for UPS Blue Label Air. \$10.00 minimum order. Bay Area Residents add 6 1/2% sales tax. California Residents add 6% sales tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Send SASE for complete list.

CIRCLE 14 ON FREE INFORMATION CARD

AMERICAN LUNG ASSOCIATION

The Christmas Seal People®

Space contributed by the publisher as a public service

WRITE FOR McGEE'S SPEAKER & ELECTRONICS CATALOG

1001 BARGAINS IN SPEAKERS

Tel.: 1 (816) 842 5092

1901 MCGEE STREET KANSAS CITY, MO. 64108

FANON

BLAZING NEW TRAILS IN ELECTRONICS SINCE 1949

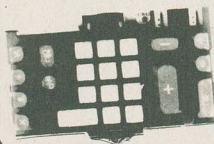
FANON/COURIER CORPORATION 15300 San Fernando Mission Blvd. Mission Hills, California 91345 (213) 365-2531

4 in kit • CAPACITANCE METER 1pF to 999Kuf
• FREQUENCY COUNTER 35MHz
• SQUARE WAVE GEN. 1Hz to 99KHz-
• OHMMETER - 3.58MHz Xtal - Regulated PS - Five .8" Readouts - Low cost TTL Circuits - Automatic Decimal Placement - Be AMAZED - Build it for \$50 or less. I Purchase the plans, etched P.C. board 4-3/4" by 6-3/4" and front panel decal for \$15.29 BAGNALL ELECTRONICS, Refund 179 May Street, Fairfield, Conn. 06430 any Kit

CAPACITORS!! Radial Leads

2mfd/50V.....	.15
220mfd/25V.....	.35
470mfd/75V.....	.65
500mfd/35V.....	.48
2200mfd/50V.....	1.69
3300mfd-25v.....	1.60

Calculator Keyboard



Mounted on PC Board
23 Key Function
1 Led 1 Slide Switch

\$2.99

DIP SWITCH

All Made By CTS
4 Pos. DPDT \$1.04

5 Pos. SPST.....\$1.00
6 Pos. SPST.....\$1.06
10 Pos. SPST.....\$1.70

I.C.'s:

SN74163N.....	69¢
SN74175N.....	69¢
SN7420N.....	20¢
DM74151.....	49¢
74LS86.....	35¢
74H20.....	25¢
DM7495N.....	49¢
SN74157.....	49¢
DM74161AN.....	69¢
DM74LS86N.....	35¢
DM74H50N.....	49¢
74H103N.....	1.19
74LS74.....	35¢
74H11.....	49¢
74H01.....	49¢
74LS241.....	1.65
DM7445.....	79¢
74LS85.....	95¢
74LS298N.....	95¢
MM74C93N.....	99¢
SN745280N.....	2.25
74LS191N.....	95¢
74LS195.....	85¢
74LS123N.....	85¢
SN74LS138.....	69¢
MC838P.....	1.45

GAME CHIP:

AY-3-8600-1.....3.95

Non Polarized

2.2mfd/25V......35

F.P. CANS

3000mfd/50V

\$1.29

6800mfd/50V

\$1.89

Buzzer

9 Volt Only

65¢

Momentary Pushbutton Switch

5 amp 36V. D.C.

SPST 89¢

In-Line Fuseholder

Comes With 3A Fuse

46¢

Trim Pots

Made By CTS

Bulk Packed

ALL VALVES

20¢ each

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

250ohm, 8k, 25k, 50k, 500ohm, 20k, 30k

A.C. Adapters

9 volt 100 mil W/2½mm plug - \$1.25

9 volt 200 mil W/2½mm plug - \$1.99

Reed Relax

6 volt .5 amp

10 watt 200 V. D.C. Switch

99¢

IN34 Special

25/\$1.00

IN4148

15/\$1.00

6.3 Volt Grain of Wheat Lamp

50¢

Precision Crystal

5.0688 mhz

\$3.95

12 Pin Edge Connector, Single Sided

only 49¢

Cable TV Accessories

VHF-UHF-FM 75r To 300 ohm Matching Transformer

79¢ ea.

2 Set 75 ohm Coupler/combiner

\$2.49 ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

75 ohm Connector 24" ea.

Teletype Paper

4½" Diam. 8½" wide

White Bond Single Copy \$3.00 per Roll

\$25.00 For 12 Rolls

TRIMMER CAP

Only 39¢

2-23PF

Dipped Tantalums

1/16 Volts.....29

1/25 Volts.....35

4.7/35 Volts.....62

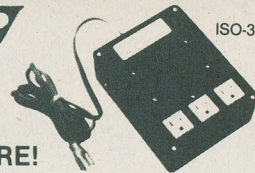
15/10volt.....39¢

.33/35volt.....29¢

10/20volt.....69¢

ESP

DON'T BLAME THE SOFTWARE!



Pat. #4,259,705

Power Line Spikes and Hash often cause memory loss or erratic operation. Often floppies, printer & processor interact!

OUR patented ISOLATORS eliminate equipment interaction AND curb damaging Power Line Spikes, Surges and Hash.

Filtered 3-prong sockets and integral Spike Suppression. 125 VAC, 15 Amp, 1875 W Total - 1 KW per socket.

ISO-1 ISOLATOR. 3 Filtered Sockets; 1000 Amp 8/20 usec Spike Suppressor \$62.95

ISO-4 ISOLATOR. 6 Filtered Sockets; 1000 Amp 8/20 usec Spike Suppressor \$106.95

ISO-3 SUPER-ISOLATOR. 3 DUAL filtered Sockets; 2000 Amp 8/20 usec Spike Suppressor \$94.95

ISO-7 SUPER-ISOLATOR. 5 DUAL filtered Sockets; 2000 Amp 8/20 usec Spike Suppressor \$154.95

Master Charge, Visa, American Express
TOLL FREE ORDER DESK 1-800-225-4876 (except AK, HI, MA, PR & Canada)

Electronic Specialists, Inc.

171 South Main Street, Natick, MA 01760

Technical & Non-800: 1-617-655-1532

CIRCLE 43 ON FREE INFORMATION CARD

NOW! A 12 HOUR TAPE RECORDER for only \$95.00*

High quality AC-DC Cassette Recorder provides 6 continuous hrs. of recording & play back of top quality true fidelity, distortion free sound on each side of cassette for a total of 12 hrs. Built-in features incl. • Voice level control • Auto. tape stop • Digital counter, etc. AC Adapter & TDK DC-180 Cassette incl.



PHONE RECORDING ADAPTER

Record incoming and outgoing calls automatically with this all solid state unit connected to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up. FCC APPROVED

VOX VOICE ACTIVATED CONTROL SWITCH

Solid state. Self contained. Adjustable sensitivity. Voices or other sounds automatically activate and control recorder. Uses either recorder or remote mike. \$24.95*
*Add for ship. & hdg. Phone Call Adapter & VOX \$1.50 ea.—Recorder \$4.00. Cal. Res. add tax. Mail order, VISA, M/C, cod's ok. Qty. disc. avail. Money back guar. Free data. Dir. inq. inv. AMC SALES, Dept. 19, 9335 Lubec St., Box 928, Downey, CA (213) 90421 Phone 869-8519

CIRCLE 41 ON FREE INFORMATION CARD

ELECTRONIC MART

90 E. Water Street
Chillicothe, Ohio 45601
614/773-1313
CHECK, MONEY ORDERS
VISA, MASTERCARD

Terms: \$10.00 minimum order
Add \$4.00 for shipping & handling (sorry no COD's)
OHIO RESIDENTS ADD 4% SALES TAX

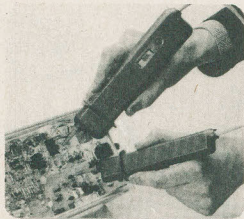
SEND FOR FREE CATALOG



STEINEL HANDHELD 3½-DIGIT MULTIMETER

The hand-held instrument is a persuasive concept —

- since you can apply the two probe tips directly to any potential points by hand, when measuring potential differences.
- since the points being tested and the display reading are in view simultaneously
- since the scale range selected can be changed while making a measurement.
- since the dimension symbol appearing in the display ensures unambiguous reading.
- since you can store the reading displayed if the test points are at fairly hard-to-reach sites, and
- since you can carry this meter with you at all times, thanks to its small size, without having to transport additional parts such as a lead or battery charger.



D.C. VOLTAGES from 0.1 mV to 500 V
A.C. VOLTAGES from 10 mV to 500V
RESISTANCES from 0.1 Ω to 20 MΩ
High-contrast 3½-digit liquid crystal display
Automatic DIMENSION and DECIMAL POINT DISPLAY
Automatic POLARITY INDICATION
INTEGRATING A/D CONVERTER using the dual slope method, on a CMOS L.S.I. single chip, providing high resistance to ageing, high reliability, and AUTOZERO function.
Pushbutton READING STORAGE, so that measurements can be made even in hard-to-reach places, and then the display brought out to where it can be read.
The ROLLING CONTACT SLIDING SWITCH and the multi-layer circuit board provide great reliability and convenience; the scale range can be changed during measurements.

TECHNICAL SPECIFICATIONS

High INPUT IMPEDANCES of more than 10 MΩ — even in the A.C. ranges; input impedance of more than 1 GΩ in the 200 mV D.C. range, with a resolution of 100 μV
FOOLPROOF OPERATION in all scale ranges up to 500 Veff
Built-in Ni-CD STORAGE BATTERY
INTEGRATED BATTERY CHARGER — can be recharged without accessories at any supply voltage between 110 and 240 V, 50 or 60 Hz; overcharge-proof
BATTERY VOLTAGE reading 12 hours' continuous operation per charge; Charging time at 220 V/50 Hz is 17 hours
SIZE AND WEIGHT:
Display unit, without probe tip 185 x 44 x 17 mm
Battery unit, without probe tip 135 x 32 x 16 mm
Length of connecting lead 1 m
Weight of complete meter 250 g

Order No. 1477.....\$169.00 case.....\$10.00

Introducing the full featured, expandable color computer!



Commodore

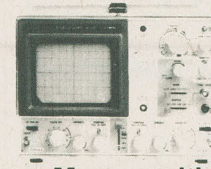
VIC-20 only \$299.95

EPROM 2716-5 (5 VOLT) \$6.50

EPROM Erasing Lamps

- ERASES 4 CHIPS IN LESS THAN 20 MINUTES
- SIMPLE TO USE • SAFETY INTERLOCK
- ERASES 2708, 2716, 1702A, etc.

UVS-11E.....\$85.00



30 MHz HITACHI
DUAL TRACE
PORTABLE OSCILLOSCOPE

MODEL V-302B \$995.00

More sensitive to your input

SORCERER COMPUTER — Speaks Your Language

FEATURES: 280 - 4K ROM - 32K RAM - Dual Cassette I/O - 30 Lines of 64 Characters - 64 Defined Characters and 64 User Defined Characters - 512 x 240 Graphic Resolution - Edge Card Connection to S-100 Bus - Serial and Parallel I/O.
Order Part No. DP1002-2 32K....\$1395.00

ANCRONA
STORES DO NOT ACCEPT MAIL ORDERS
MAIL ORDER
P.O. BOX 2208R CULVER CITY, CA 90230

PHONE ORDERS (213) 641-4064

Minimum Order \$10.00. Add \$2.00 to cover postage and handling. Master Charge and VISA welcomed. Please include your charge card number, interbank number and expiration date. Some items are subject to prior sale. Not responsible for typist. Store pricing may vary from Mail Order pricing. We reserve the right to substitute manufacturer.

MEMORIES

		1-9	10 up	100 up
2102-1	(500 ns)	\$2.00	\$1.80	\$1.10
2114L-2	(200 ns)	3.50	2.95	2.60
2114-3	(330 ns)	3.40	2.80	2.50
2114-2	(200 ns)	3.50	2.95	2.60
4116	(200 ns)	3.00	2.20	2.00
2708		3.50	3.30	3.10
2716	(5v)	6.50	4.80	4.50
2732	(350 ns)	13.00	11.00	9.90

VISIT A STORE NEAR YOU TODAY - We stock a large selection of Technical Books, Discrete Components, Integrated Circuits, Test Equipment and Electronic Supplies.

ATLANTA	CULVER CITY	HOUSTON	PORTLAND	SANTA ANA	SUNNYVALE	TUCSON
3330 Piedmont Rd. N.E. Atlanta, GA 30305 (404) 261-7100	11080 Jefferson Blvd. Culver City, CA 90230 (213) 390-3595	2649 Richmond Houston, TX 77098 (713) 529-3489	1125 N.E. 82nd Ave. Portland, OR 97220 (503) 257-9464	1300 E. Edinger Ave. Santa Ana, CA 92705 (714) 547-8424	1054 E. El Camino Real Sunnyvale, CA 94087 (408) 243-4121	4518 E. Broadway Tucson, AZ 85711 (602) 881-2348

CIRCLE 28 ON FREE INFORMATION CARD

COMPUTERS ATARI® 800™ COMPUTER SYSTEM

16k → \$750.00
48k → \$898.00

"APPLE II Plus"

48k → \$1199.00
64k → \$1399.00

ATARI Software
Missile Command
Asteroids
Star Raiders
Chess

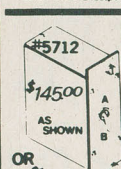
All/ \$3600/ea

REAL-TIME CLOCK CALENDAR (MSM 5832)

Description: Mono Metal Gate CMOS I.C.

Features:
Time, Month, Date, Year, &
Day of Week
Bus Oriented
4 Bit Data Bus
4 Bit Address
R/W Hold Select.

\$7.45
XTAL
\$2.85



OR
\$145.00

AS SHOWN

SHELF/DESK
MOUNTED \$572

\$155.00

DESC.

MS 232 COMPATIBLE DIGITAL TRANSFER SWITCH WILL SWITCH MONITOR, PRINTER, AND/OR OTHER PERIPHERALS.

24 PIN D-SUB CONNECTOR PIN 1 WIRE TO GROUND

T-bar

BEST SELLERS!

Sybox → "Microprocessors"

Osborne \$15.00/ea.

Apple II user's Guide

POWER SUPPLY

MODEL #CP198

input - 110/125V

output - 5Vdc

at 6amps

\$29.95

Qty price avail.

★

PROTO CLIPS

14 PIN → \$4.35

16 PIN → \$4.50

24 PIN → \$8.75

40 PIN → \$14.75

CARDS

MICROSOFT

Z80

\$295.00

16K RAM

\$160.00

VIDEO

VIDEO TERM

90 column

\$295.00

KEYBOARD

ENHANCER

\$120.00

CALIF COMP SYS

APPLE

CLOCK

\$124.00

PROTO

BOARD

\$250.00

PRINTERS

EPSON

MX-80

\$535.00

"FT" \$645.00

Interface & cable

\$78.90

★

CONCORD COMPUTER PRODUCTS

1971 SO. STATE COLLEGE
ANAHEIM, CALIF. 92806

(714) 937-0637
CHECK — M/O
VISA NO COD

\$10. MIN ORDER / CA RES. ADD 6% FRT

\$10-49 \$2.00 \$250-499 \$9.00

50-99 4.00 500-999 11.00

100-240 8.00 1000-UP CALL

★SPECIALS★

ZENITH ZVM-121 Video Monitor: Green Phosphor

12 inch 15+Mhz → \$139.00

3 inch MUFFIN FAN w/cord → \$9.95

UPD 765: Floppy Disk Cont. → \$19.95

8155- RAM → \$11.50

8255-PPI → \$7.95

2111- Static RAM → \$1.75

8085A- CPU → \$8.50

MC 6800- CPU → \$7.75

ER 2501- EAROM → 4.95

"81" I.C. MASTER

\$59.95

8748-8 → \$31.00

3341PC → \$2.00

MM5060 → 35¢

MONITORS

"AMDEK Corp."

video 100

\$129.00

12 inch

12MHz

BLACK & WHITE

VIDEO MONITOR

AMDEK (LEXED) Corp.

\$365.00

video 100

\$155.00

12 inch

12MHz

GREEN PHOS

COMPONENTS

SN7400N	16	SN7482N	30	74S00	.39	74S138	.75
SN7402N	22	SN7492N	49	74S02	.45	74S140	1.00
SN7404N	21	SN7493N	45	74S04	.38	74S158	.75
SN7408N	22	SN7495N	50	74S10	.39	74S174	1.35
SN7410N	18	SN7499N	99	74S15	.45	74S175	1.35
SN7412N	20	SN74122N	39	74S15	.45	74S182	.75
SN7413N	22	SN74136N	95	74S15	.45	74S189	4.25
SN7414N	29	SN74141N	69	74S20	.55	74S201	6.75
SN7416N	27	SN74151N	65	74S22	.55	74S208	2.95
SN7417N	29	SN74153N	55	74S30	.75	74S244	2.95
SN7420N	17	SN74154N	125	74S37	.55	74S251	2.75
SN7425N	20	SN74155N	75	74S50	.65	74S287	2.95
SN7430N	17	SN74157N	58	74S51	.49	74S298	1.95
SN7437N	26	SN74160N	89	74S64	.55	74S299	5.75
SN7438N	24	SN74161N	85	74S74	.65	74S470	9.25
SN7440N	18	SN74163N	65	74S85	.95	74S471	9.50
SN7442N	45	SN74164N	87	74S112	1.95	74S473	9.50
SN7443N	42	SN74165N	55	74S132	1.45	74S474	9.50
SN7445N	64	SN74174N	88				
SN7451N	19	SN74175N	79				
SN7454N	19	SN74180N	75				
SN7474N	27	SN74181N	1.15				
SN7475N	35	SN74393N	1.05				

74LS00

74LS00	28	74LS158	69	74S00	.39	74S138	.75
74LS02	28	74LS161	83	74S02	.45	74S140	1.00
74LS03	28	74LS162	89	74S04	.38	74S158	.75
74LS04	28	74LS163	98	74S10	.39	74S174	1.35
74LS05	22	74LS164	65	74S15	.45	74S175	1.35
74LS06	29	74LS165	65	74S15	.45	74S182	.75
74LS08	28	74LS166	155	74S20	.55	74S189	4.25
74LS10	28	74LS170	175	74S22	.55	74S201	6.75
74LS14	89	74LS174	85	74S30	.75	74S208	2.95
74LS20	22	74LS175	85	74S37	.55	74S244	2.95
74LS21	26	74LS190	85	74S50	.65	74S251	2.75
74LS26	40	74LS191	125	74S51	.49	74S287	2.95
74LS27	27	74LS195	85	74S64	.55	74S298	1.95
74LS28	37	74LS197	78	74S74	.65	74S299	5.75
74LS30	29	74LS221	1.25	74S85	.95	74S470	9.25
74LS32	31	74LS240	1.65	74S85	.95	74S471	9.50
74LS38	31	74LS241	1.65	74S112	1.95	74S473	9.50
74LS42	63	74LS243	1.55	74S132	1.45	74S474	9.50
74LS48	77	74LS244	1.55				
74LS74	38	74LS245	2.45				
74LS76	56	74LS251	1.25				
74LS86	45	74LS253	85				
74LS90	50	74LS257	85				
74LS93	65	74LS259	1.95				
74LS98	80	74LS260	55				
74LS107	43	74LS273	1.55				
74LS113	45	74LS279	.45				
74LS122	45	74LS280	1.25				
74LS123	89	74LS283	1.65				
74LS125	85	74LS365	85				
74LS126	79	74LS367	75				
74LS138	64	74LS373	1.45				
74LS139	59	74LS374	1.45				
74LS151	49	74LS377	1.25				
74LS153	49	74LS369	1.55				
74LS157	69	74LS370	1.85				

TERMINALS

Synertek "KTM-3"

LOW COST

TERMINAL WITH

KEYBOARD AND

VIDEO 100

GLOBAL SPECIALTIES CORP.

LOGIC PROBES	EXPERIMENTOR SOCKETS	QUICK TEST SOLDERLESS BREADBOARD ELEMENTS
LP-1 \$50.00	EXP-300 \$10.50	QT-595 \$12.00 QT-59B \$2.75
LP-2 28.00	EXP-300PC 2.40	QT-475 9.50 QT-47B 2.50
LP-3 76.00	EXP-350 6.10	QT-355 7.25 QT-35B 2.10
IC TEST	POWERED	QT-185 4.25 QT-12S 3.75
CLIPS	PROTO-BOARD	QT-8S 3.00 QT-7S 2.75
PC-14 \$4.00	PB-104 \$70.00	
PC-16 4.10	PB-102 53.00	Logic Monitor JUMPER
PC-24 9.00	PB-101 26.00	100K Impedance WIRE KIT
PC-40 14.00	PB-100 20.10	LM-1 \$75.00 WK-1 \$9.00

VECTOR

P184	SUIT-N-WRAP TOOL, w/50' spool of 28 gage wire	\$30.00
P160-1B	DUAL-WAY UNWRAP TOOL, Unwraps 26-30AWG	\$12.10
P160-2A	DUAL-WAY WRAP-N-STRAP TOOL, Wraps 26-30AWG	\$12.50
8804	UNIVERSAL Microcomputer/Processor Plugboard	\$27.65
8800V	UNIVERSAL Microcomputer/Processor Plugboard, for Altair 8800 & IMSAI 8080	\$24.95
4607	UNIVERSAL Computer Plugboard, fits DEC LSI-11, PDP-8, PDP-11 and Heathkit H-11	\$20.40
4609	MICROPROCESSOR PLUGBOARD, for Apple II	\$23.90

WE STOCK THE FULL VECTOR LINE. Catalog Available On Request

TECHNICAL DATA AND COMPUTER BOOKS

An Introduction to Microcomputers (The Beginners' Book...\$7.95, An Introduction to Microcomputers (Basic Concepts)...\$12.95, 4 and 8 Bit Microprocessor Handbook \$19.95, 16 Bit Microprocessor Handbook \$19.95, The CRT Controller Handbook...\$6.99, The 68000 Microprocessor Handbook...\$6.99, Z80 Assembly Language Programming...\$16.99, 6802 Assembly Language Programming...\$16.99, 6809 Assembly Language Programming...\$16.99, Business System Buyer's Guide...\$7.95, CP/M User's Guide...\$12.99, Apple II User's Guide...\$15.00, Microprocessors for Measurement & Control...\$15.99, CBASIC User's Guide...\$15.00, Interfacing to S-100/IEEE 696 Microcomputers...\$15.00, Some Common Basic Programs...\$14.99, Practical Basic Programs...\$15.99, Some Common Basic Programs — Atari Edition...\$14.99, Some Common Basic Programs — TRS-80 Level II Edition...\$14.99, Science and Engineering Basic Programs — Apple II Edition...\$15.99

LINEAR DEVICES

LM301N \$.32	LM317N 1.15	LM384N \$1.75	LM741N \$.35
LM305H .75	LM318N 1.95	NE555N .36	LM747N .55
LM307N .40	LM319N 1.65	NE566N .70	LM1458N .40
LM308N 1.10	LM323K 5.00	NE561N 3.69	LM1488N .80
LM309N 2.00	LM324N .50	NE565N .85	LM1489N .80
LM310N 1.75	LM337N 1.50	NE566N 1.65	LM1493N .70
LM311N .45	LM339N .50	NE567N .85	7812CK 1.60
LM386N 1.10	LM380N .50	LM723N .45	7815CK 1.60

7400 SERIES TTL

7400 \$1.19	7426 \$2.25	7483 \$.50	74125 \$.48	74182 \$1.00
7401 .19	7428 .40	7486 .35	74132 .55	74184 2.05
7402 .19	7432 .25	7495 .45	74141 .80	74185 2.05
7403 .19	7439 .30	7496 .50	74156 .50	74193 .70
7404 .19	7442 .40	74116 1.30	74161 .60	74199 1.10
7410 .20	7448 .75	74121 .35	74165 .60	74221 .80
7420 .20	7474 .35	74123 .50	74181 1.65	

LOW POWER SCHOTTKY TTL

74LS00 \$.22	74LS42 \$.50	74LS136 \$.35	74LS195 \$.60
74LS01 .22	74LS47 .80	74LS138 .55	74LS198 .80
74LS02 .22	74LS54 .30	74LS151 .55	74LS241 1.10
74LS04 .25	74LS74 .35	74LS153 .55	74LS244 1.10
74LS08 .25	74LS76 .35	74LS156 .60	74LS248 .90
74LS10 .25	74LS83 .60	74LS158 .50	74LS257 .55
74LS11 .30	74LS86 .35	74LS161 .70	74LS266 .65
74LS12 .30	74LS92 .30	74LS163 .70	74LS268 .65
74LS20 .25	74LS96 .70	74LS166 2.10	74LS295 .85
74LS21 .30	74LS112 .35	74LS169 .95	74LS352 1.00
74LS26 .30	74LS122 .40	74LS174 .60	74LS366 .45
74LS28 .45	74LS123 .70	74LS181 1.85	74LS368 .45
74LS32 .30	74LS125 .45	74LS193 .75	74LS393 1.20
74LS38 .40	74LS132 .65	74LS194 .60	74LS395 1.20

4000 SERIES CMOS

4001 \$.30	4012 \$.28	4022 \$.90	4041 \$1.05	4070 \$.40
4002 .30	4013 .40	4023 .30	4042 .80	4086 .90
4006 1.05	4014 1.00	4024 .75	4047 1.20	4510 1.05
4007 .28	4015 1.00	4028 .70	4049 .40	4512 1.00
4008 .90	4016 .50	4032 2.00	4050 .40	4516 1.05
4010 .50	4019 .50	4034 2.50	4051 .85	4532 1.50
4011 .30	4021 .30	4040 1.05	4066 .55	4538 1.50

LED DISPLAYS

FND357 \$1.50	FND800 \$1.95	MAN4610 \$2.10	MAN6710 \$3.10
FND500 1.50	MAN3620 2.00	MAN6640 4.10	MAN6750 2.90
FND507 1.50	MAN3630 2.00	MAN6650 4.10	MV5023 .25

DIP SOCKETS

STANDARD TIN	WIRE LOW
14 \$.65	\$.30
16 .73	.34
18 .82	.38
20 1.02	.42
24 1.10	.51
28 1.28	.59
36 1.65	—
40 1.83	.85

EPROM PROGRAMMING

Suntronics will reproduce your program on an EPROM supplied by us from your Master PROM/EPROM only.

DEVICE	1st EPROM	ADDITIONAL EPROM's
2708 \$ 8.95	\$ 7.00	
2716 19.95	16.00	
2732 27.00	28.00	

Optional Listing... \$5.00

Send your Master EPROM/PROM with order. Be sure to pack in anti-static material, and protect it properly (we are not liable for shipping damage).

5% Carbon Film Resistors
IN ALL VALUES
1/4W 10 for 40¢ 1/2W 10 for 50¢

WE STOCK SPRAGUE CAPACITORS & SWITCHES

MICROPROCESSORS	RAMS
Z-80 \$9.20	8800 \$7.50
Z-80A 9.50	8035 5.50
8080A 4.50	6809 23.50
8085A 5.70	8086 95.50
8088A SUPPORT DEVICES	
8212 \$2.25	8253 \$7.50
8216 2.00	8257 10.00
8224 2.50	8259 11.50
8228 4.50	8275 32.00
8238 4.50	8279 7.20
8251 4.90	

16K RAM EXPANSION KIT
For TRS-80 (Model I or III), Apple or PET computers

Set (8 pcs. UPD416C-2 (200ns) \$15.95
Data furnished with purchase on request.

MICROPROCESSOR INTERFACE IC's

8726 \$2.15	8797 \$1.49	74LS242 \$1.79	74LS245 \$2.85
8728 2.30	8798 1.49	74LS243 1.79	74LS273 1.69
8795 1.49	74LS241 1.10	74LS244 1.10	74LS373 2.50

WE ALSO SPECIALIZE IN JAPANESE COMPUTER AND ELECTRONIC PARTS

CALL FOR VOLUME QUOTATIONS

OUR NEW CATALOG AVAILABLE ON REQUEST

SUNTRONICS CO., INC.
12621 CRENSHAW BLVD. Dept. R
HAWTHORNE, CALIFORNIA 90250
(LOCATED NEXT TO FORMULA INTERNATIONAL)
STORE HOURS: Mon.-Fri. 10am to 6:30pm — Sat. 10am to 5pm
IN CALIFORNIA OUTSIDE CALIFORNIA TOLL FREE
(213) 644-1149 1-800-421-5775

Mail Order — No Minimum: Send Money Order or Check to:
P.O. BOX 1957, HAWTHORNE, CA 90250. Use your VISA or MasterCard (please include expiration date). Add \$2.00 postage and handling to order. California residents add 6% sales tax.

MOOSE™

National Semi LM396 is a 10A, 70W regulator adjustable from 1.25V to 15V. This new regulator has current limiting, thermal limiting and is immune to blowout from overload and shorts. TO-3 package requires only 2 external resistors to set output voltage.

LM396 with specs \$19.95

SUPER CAP

How about a *One Farad* (That's right, 1 Farad) cap for use as a reserve power source for memory backup. No more worrying about NICAD charging times or failures. Supercaps supply up to 10mA for 30 seconds or 1uA for approximately 1 week. Only 1 1/4" dia. x 3/4" tall. P.C. mt. leads. 2 voltages available.

FAOH105Z 5V \$10.50

FAOH110Z 10V \$10.50

REMOTE CONTROL TRANSMITTER/RECEIVER

LM1871/1872 chip set has the RF and encode/decode for up to 6 channels of analog or digital link! Never an easier way to control toys, industrial processes, security systems...etc.

Low power for battery operations (6V). Interfaces with standard hobby servos or control instruments.

LM1871/1872 set with specs \$15.95

D SUBMINIATURE CONNECTORS

(Compare these prices!)

PLUGS	1-9	10-24	25-99
NEZ9P	\$1.95	\$1.75	\$1.60
NAZ15P	2.35	2.10	1.90
NBZ25P	2.60	2.35	2.15
NCZ37P	4.55	4.15	3.80
DDZ50P	5.65	5.15	4.65

SOCKETS	1-9	10-24	25-99
NEZ9S	\$3.10	\$2.75	\$2.50
NAZ15S	4.20	3.75	3.45
NBZ25S	3.35	3.05	2.85
NCZ37S	8.85	8.00	7.35
NDZ50S	11.65	10.60	9.65



7808 N. 27th Avenue
Phoenix, Arizona 85021

ORDER TOLL FREE: 1-800-528-0183
(Order desk only)

TERMS: \$10.00 minimum order.
Visa, MC, BAC, Check, M.O. or UPS C.O.D.
U.S. Funds only. AZ residents add 5% sales tax.
Prepaid orders over \$50 shipping prepaid.

OTHERS: Add \$3.00 shipping & handling.
Add \$1.50 for C.O.D. orders.
Outside U.S., add 20%.

CIRCLE 31 ON FREE INFORMATION CARD

ETCO

CABLE TV CONVERTERS AND OTHER GOOD STUFF!

SMASHING ALL SALES RECORDS — OUR NEW 30 CHANNEL CABLE TV CONVERTER!

Converts mid & super band cable channels for viewing on your TV set!
No. 349AE047

39⁹⁵ \$34.95 ea. / 5

HOT NEW IMPORT! REMOTE CONTROL 30 CHANNEL CABLE TV CONVERTER!

89⁹⁵ \$79.95 ea. / 5 \$74.95 ea. / 10

Includes remote TV on/off switch and fine tuning control!
No. 349VA275

ETCO MKII WIRELESS — THE ULTIMATE CABLE TV CONVERTER!

Set TV to channel 3, and the hand-held remote control does it all!
No. 349ZA008

189⁰⁰

VIDCOR 2000 CONVERTER ELIMINATES PROBLEMS WHEN VIDEOTAPING FROM CABLE TV

89⁹⁵ \$79.95 ea. / 5 \$74.95 ea. / 10

Restores your VCR's capability for programming. Restores remote channel control. Enables videotaping of one cable program while watching another.
No. 349VA950

UNUSUAL FACTORY SURPLUS MID-BAND — SUPER-BAND CABLE TV TUNER

Converts cable channels to a common IF frequency. Experimenters — build cable converters, decoders, etc. With schematic. No. 349VA342

19⁹⁵ \$17.50 ea. / 10

349VA389 - Detailed schematic & spec sheet - \$1.50

FACTORY SURPLUS UHF TUNERS

4⁹⁵ \$3.95 ea. / 10

Brand new production surplus. All solid state. Ideal for experimental work, building, cable TV converters, etc. No. 349SU099

MINIATURE FM WIRELESS MICROPHONE

Hides in the palm of your hand. Reception on any standard FM radio or receiver.
No. 349VA482

29⁹⁵ \$27.50 ea. / 5 \$24.95 ea. / 10

QUARTER-MILE WIRELESS MICROPHONE & RECEIVER SYSTEM

FCC approved crystal controlled wireless mike & receiver. All battery operated. Electret wide-range response. VU meter.
No. 349VA093

69⁹⁵ \$49.95 ea. / 5

FACTORY SURPLUS VHF / UHF "TWIN" VARACTOR TUNERS!

Admiral No. NC 3143-1. BRAND NEW! Ideal for building or repairing electronically tuned TV "FRONT ENDS". A hard to find item at a sensational price! No. 349VC308

39⁹⁵ \$34.95 ea. / 5

DUMPING! NORELCO ENDLESS LOOP CASSETTES!

4⁹⁵ \$4.49 ea. / 10

Impossible to find at any price!
3 minutes — No. 349VA605
6 minutes — No. 349VA606

IN STOCK — THE MURA CORDLESS TELEPHONE SYSTEM!

Answer & originate calls with this wireless cordless telephone. 400 ft. range! Rechargeable! Lasting feature! Use with rotary, touch systems!
No. 349VA274

144⁸⁸ \$129.95 ea. / 5

SALE OF QUARTZ BATTERY-OPERATED CLOCK MOVEMENTS!

Accuracy of 1 min. / year up to 4 years operation on 1 "alkaline" "C" cell. Imported from West Germany. No. 349VA565

9⁹⁵ \$8.95 ea. / 5

349VA565 Matching hands. \$2.49/set. \$1.95/set / 5

20 AMP REGULATED 12VDC POWER SUPPLY!

13.8 vdc no load, 12.5 vdc full load. Easily handles ham station, marine radio, SSB linears up to 400w P.E.P. Brand new, factory sealed. 110 VAC. No. 349VA394

69⁸⁸ \$59.88 ea. / 5

349VA395 - as above, 10 amps — \$54.95. \$49.95 ea. / 5

FREE

OUR LATEST 98 PAGE FASCINATING CATALOG — jam packed with unique items, electronic bargains and unusual offers. Write or circle the information card number below.

ETCO ELECTRONICS NORTH COUNTRY SHOPPING CENTER
PLATTSBURGH, N.Y. 12901

Check with order, please. Visa & Mastercard OK. (Sorry, no C.O.D.'s. Add 15% for UPS & Handling (Excess refunded). N.Y. State residents add 7% sales tax. Dealer & Export inquiries invited. Our telephone order desk never closes.
Call 1-518-561-8700.

CIRCLE 32 ON FREE INFORMATION CARD

ALTEX ELECTRONICS

618 W Sunset
San Antonio, Texas
78216

In Texas Call
(512)828-0503

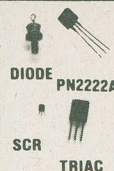
1-800-531-5369

\$3.95



SONALERT

Mallory SNP-428
4-28 VDC, 3-16 ma
Fits 1 1/16" hole



SEMICONDUCTORS

Diode MR 1130R, 12 Amp,
1000V, DO-4 \$1.25
PN2222A, TO-92
10 for \$1.00, 100 for \$7.00
SCR 30V, 800 ma TO-92
10 for \$2.00, 100 for \$15.00
Triac MAC 10-4
200V, 10 A \$1.25



CRYSTAL
1.0 MHz
HC33/U
\$3.95

TERMS

Quantities Limited
COD, check, money order
VISA, Mastercard
Tex. res. add 5 1/2% state
sales tax. Add \$3.00 shipping
charges for orders under \$50

\$1.00

Capacitors - Axial Lead

200 Mfd.	100 volt	1 5/8 x 7/8	\$1.00
250 Mfd	150 volt	2 5/8 x 7/8	\$1.00
370 Mfd	200 volt	3 5/8 x 1	\$1.00
450 Mfd	250 volt	3 5/8 x 1	\$1.00
700 Mfd	100 volt	1 5/8 x 7/8	\$1.00

CONNECTOR

RS-232
connector,
DBC-25-P male,
crimp pin, \$2.25
DB-25 cover
\$1.25

DYNAMIC RAMS

D2104A 16 pin 4Kx1 300ns
TMS4030 22 pin 4Kx1 300ns
95c

PROM

7640 24 pin 512 x 8 VOL OC
\$7.95

UART

COM 2502 40 pin 25 KHz +5 - 12
\$4.95

EDGE CONNECTOR

43/86 pin
(double)
.156 spacing
gold plated
solder eyelets
\$3.95

AUDIO CASSETTES

C-30 Memorex
ATC
(15 min.
per side)
each . . . 50c
**box of
50 . . \$20**

PRINTED CIRCUIT BOARDS

2 oz. copper clad one side
1/16" FR-4 glass epoxy

4.5" x 6.5"	\$1.00
6.0" x 6.0"	\$1.25
6.0" x 12.0"	\$2.25
12.0" x 12.0"	\$4.25



JOYSTICK
4-10K linear pots
1 1/2" metal
handle
dimensions
2 1/8" square
\$5.95



POWER SUPPLY

Input
110 - 220 VAC
Output
+5VDC - 5 Amp
+12VDC - 1 Amp
-12VDC - Amp
5 3/4" x 7 1/2" x 4 1/4"
\$67.50



COIL
6KV trigger
coil for strobe
\$1.25



JACK

Switchcraft
12A 1/4"
phone jack
w/switch
25c each



EDGE METER
0-15 V.D.C.
25/32" x 1 13/16"
\$3.50

POWER CORDS

2 cond. 18 ga. 92" long grey . . . 50c
3 cond. Belden 17629B 14 ga. 108"
long black type SJ . . \$2.85

SNAP ACTION SWITCHES

Micro Switch V3L-2108-DB
10 Amp, 125 VAC SPDT . . \$1.00
Unimax 2HBT-5 20 Amp
125 VAC SPDT . . \$1.50

Arm length
2 3/8
Arm length
1 3/4



SLIDE CONTROL
PCB mount.
10K linear.
1 3/4" travel
75c

TRANSFORMERS

P5400A 110-220 VAC Pri.
26.5 VCT Sec. @ 1.5 Amps
2 3/8" x 3 5/8" x 2 1/4" h
mounting holes 3 1/8 C-C
\$7.95

P5800A 110-220 VAC Pri.
50 VCT Sec. @ 2 Amps
3 1/2" x 3 1/8" x 2 7/8" h
mounting holes 2 1/2" x 2 3/8"
\$14.95



SOLDER
Kester 60/40
.020 Dia.
1 lb. roll
\$7.95

SPEAKERS

8 ohms

1 1/2"	TP-151	.1W	\$1.00
12"	12 LA10	25W	\$12.00
12"	12 LA20	50W	\$18.00
15"	15 LA20	50W	\$24.00

POTS

All with 3/8" shaft
All below without switch . . . 75c

VALUE
1K Linear
5K Linear
10K Linear
25K Linear
50K Linear
50K Audio
100K Linear
500K reverse audio
1M Linear
All below with Switch 85c
25K Linear/push-pull
50K Linear/push-pull
500K Linear/turn
50K Audio/turn

STYLE
B
B,C
A,B,C
B,C
A,C
B,C
B,B
B
B,B,C
C



CIRCLE 27 ON FREE INFORMATION CARD

IS YOUR Radio- Electronics LIBRARY COMPLETE?

Back issues are available for months
from 1978 to present @ \$3.00 each,
postpaid. Please send your check
or money order to:

RADIO-ELECTRONICS®
BACK ISSUE DEPARTMENT
200 Park Avenue, South
New York, NY 10003

Name _____
(please print)
Address _____
(please print)
City _____
State _____ Zip _____
Issue(s) requested: (if available)
Month _____ Year _____
Month _____ Year _____

Applekation PP II Printer Card

The PP II parallel printer card for the
Apple II computer is designed to allow
effective use of your printer which has
special functions such as bold and
enlarged face print available through
the use of escape sequence com-
mands. Since the Apple II does not
send escape characters the software
on this board does it for you with
control characters from the keyboard.
One of the main designs of the PP II
card is that it contains space enough
for 8 independent printer driver pro-
grams so new printers are not a
problem. The PP II is software compat-
ible with both Apple Basics as well as
*CP/M or *Pascal.

*CP/M or Pascal disks providing the
appropriate bios patches are available
on special request.

PP II printer card (with cable) MX-80
or 737

\$199.95

ARKON ELECTRONICS LTD.

409 Queen St. West
Toronto, Canada M5V 2A5
(416-868-1315)



CIRCLE 38 ON FREE INFORMATION CARD



FREE!

1981
DISCOUNT
ELECTRONICS
CATALOG

JOIN THE PAK!

Send for our Free catalog and become a
member of our exclusive Pak. Our
members receive Poly Paks'

exciting catalog several
times a year. We offer:

Penny Sales, Free
Premiums and Low,
Low Prices on a wide variety of

Electronic Products such as Computer Periph-
erals, Integrated Circuits, Speakers, Audio
Equipment, Rechargeable Batteries, Solar Prod-
ucts, Semiconductors, and much, much more!
Take advantage of our 25 years as America's
foremost Supplier of discount electronics.

RUSH ME YOUR FREEDISCOUNT CATALOG!

NAME: _____

ADDRESS: _____

CITY: _____

STATE: _____ ZIP: _____

CLIP AND MAIL COUPON TODAY TO:
POLY PAKS, INC.

P.O. Box 942, RA-12
S. LYNNFIELD, MA. 01940

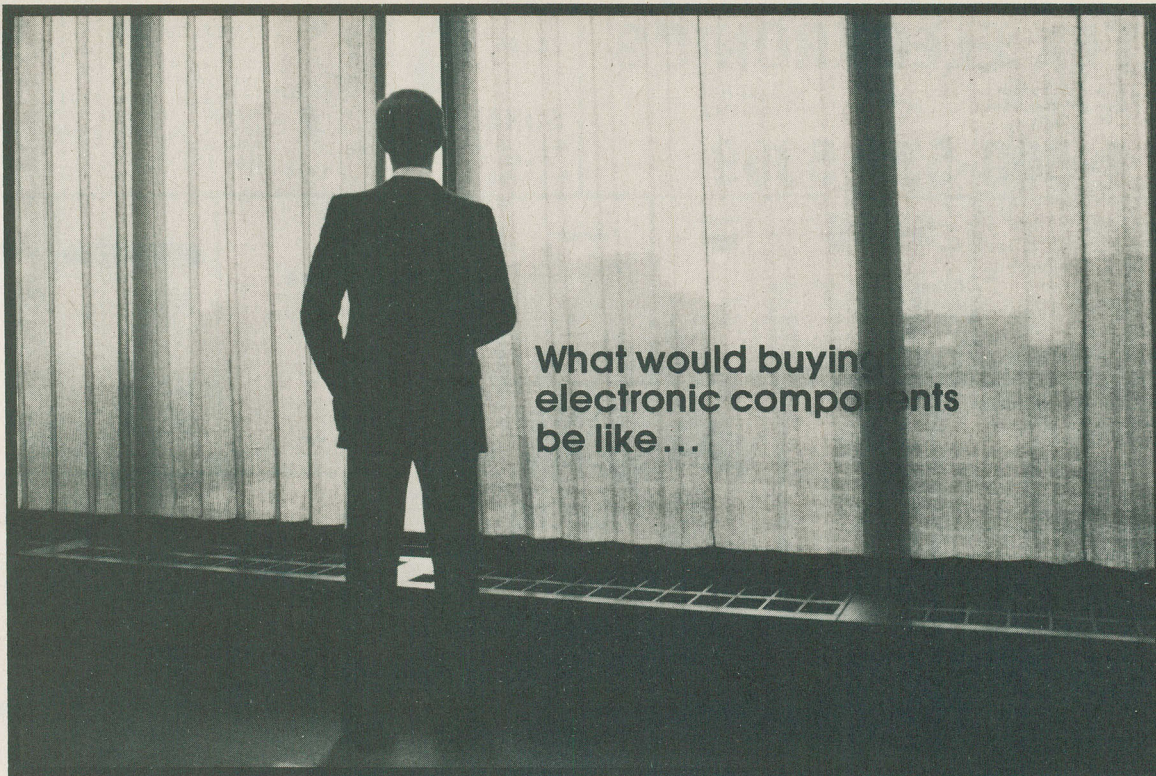
(617) 245-3828

Over
4.5 Million
Satisfied
Customers

CIRCLE 45 ON FREE INFORMATION CARD

139

DECEMBER 1981



What would buying
electronic components
be like...

if there were no distributors?

If there were no electronics distributors... we'd have to invent them! As manufacturers of electronic products, we're convinced that the absence of distributors would cripple our industry! You'd have no convenient local source for fast off-the-shelf delivery of needed products. Production lines would grind to a halt... handling small orders would be a nightmare. Paperwork would increase; costs would increase; expediting would increase; chaos would increase.

As a buyer of electronic components, you benefit from the existence of distributors, even when you don't directly utilize their services. They make the factories you deal with direct more efficient—in marketing, in scheduling, in economy of scale. And, whether you need a source for fast delivery of standard products, for comprehensive technical information, or for assistance on any aspect of your procurement function, your local distributor can—and does—fill the bill splendidly.

Distributors help us—by serving you.

As members of the Distributor Products Division of the Electronic Industries Association, the companies bringing you this message are pleased to help "sell the system."

For information about joining with other manufacturers who sell through electronic distributors, contact Herbert Rowe, Vice President, EIA Components Group, 2001 Eye Street N.W., Washington, D.C. 20006. Telephone (202) 457-4900.



DISTRIBUTOR
PRODUCTS
DIVISION

ALPHA WIRE CORP.
Wire, Cable, Tubing

AMPEREX ELECTRONIC CORPORATION
Tubes, Loudspeakers, Components

AMPHENOL NORTH AMERICA
Electrical, Electronic and Fiber-Optic
Connectors

BELDEN CORPORATION
Wire, Cable and Cords

BUD INDUSTRIES, INC.
Cabinets and Hardware

BURNDY CORPORATION
Connectors and Wire Terminations

CORNELL-DUBILIER ELECTRONICS
Capacitors, Filters and Relays

CORNING GLASS WORKS
Capacitors and Resistors

CORNING ELECTRONICS, INC.
Capacitors, Connectors, Transformers

DALE ELECTRONICS
Resistors, Connectors, Transformers
and Filters

DIALIGHT
Indicator Lights, LEDs and Switches

E. F. JOHNSON CO.
Trimmer Capacitors and Connectors

FUJITSU AMERICA, INC.
Semiconductors, Relays, Connectors

G C ELECTRONICS
Chemicals, Hardware, Tools and Wire

GRAYHILL, INC.
Switches and Relays

INDUSTRIAL DEVICES, INC.
Indicator Light Assemblies and LEDs

KEYSTONE ELECTRONICS CORP.
Electronic Hardware

KULKA ELECTRIC CORP.
Terminal Boards and Wiring Devices

MURATA CORPORATION OF AMERICA
Electronic Components

OAKTRON INDUSTRIES, INC.
Loudspeakers

OHMITE MANUFACTURING CO.
Resistors, Controls, Chokes and Switches

PHILIPS ECG, INC.
Semiconductors, Tubes

QUAM-NICHOLS CO.
Loudspeakers

REMEE PRODUCTS CORP.
Wire and Cable

SIMPSON ELECTRIC COMPANY
Analog/Digital Meters and Test Equipment

H. H. SMITH, INC.
Electronic Hardware

SOLA ELECTRIC
Voltage Regulators, Power Supplies,
UPS Systems

SPRAGUE PRODUCTS COMPANY
Capacitors, Resistors, Transistors,
Filters, ICs

STACKPOLE COMPONENTS CO.
Resistors, Switches, and Ferrite Cores

TRIPLETT CORPORATION
Indicating and Test Equipment

HI-FI MINI SPEAKER

continued from page 106

- ledge around the four sides of the enclosure. (Note: it is easiest to glue the two longer strips to opposing sides of the enclosure first, and then install the remaining two.)
15. Spread some glue evenly on the tops of the four partition mounting strips just installed.
 16. Take the assembly prepared in step 5 (partition 6) and lower it through the top of the enclosure (with the partition supports on top) until it sits firmly on the four mounting strips to which glue has just been applied. Make sure that the tube fits into the center hole.
 17. Hold the partition-6 assembly in place until the glue has set. Then glue the tube to the center hole of that partition to form an airtight seal.
 18. Mount partition 5 on the four partition supports of the partition-6 assembly.
 19. Repeat step 14, this time using the remaining partition strips and the partition-1, 2, 3, and 4 assemblies.
 20. Mount the woofer on the enclosure top as shown in Fig. 6. Note that it is attached *inside* the enclosure.
 21. Attach the top to the rest of the enclosure.
 22. Make the electrical connections to the woofer.
 23. Attached the top plate to the four top supports.
 24. Attach the bottom plate to the four bottom supports.
 25. Mount and connect the tweeter as shown in Fig. 3 or Fig. 4. If a horn-type tweeter is used, you may need to reduce the value of capacitor C1 to 1.0 μ F to prevent lower frequencies from being shunted to the tweeter and being distorted.

That completes construction of the mini-SAFE speaker system. Use it with a good medium-power (15-20 watts-per-channel) amplifier, and you'll have performance worth many times more than what you paid for the components. **R-E**

AUDIO/MUSICIANS CLOSE-OUT! WHILE THEY LAST!!!

Electronic MUSICAL KEYBOARDS

Surplus, brand new, Pratt-Read piano-type electronic keyboards. ARP instruments (famous synthesizer mfr.) gone out of business. Their loss is *YOUR* gain! Perfect for digital, analog or computer synthesizers. Gold plated contacts throughout. Worth much more!

3 Octaves—\$79.00 4 Octaves—\$99.00



Surplus Musical Instrument SPEAKERS

10" WOOFER SPEAKERS. From the same synthesizer manufacturer, as used in The "ARP" piano" power amplifier. Features heavy duty, low resonance suspension cone. Heavy alloy magnet. Quality built and selected for continuous music power drive. Should easily dissipate over 25 watts RMS.

BRAND NEW!.....\$24.00; 2/\$45.00

QUANTITIES LIMITED!!!

MID-RANGE SPEAKERS

Used with the above woofer in a superior speaker system. 4 inches in diameter, heavy duty, large alloy magnet for music power output.

BRAND NEW!.....\$8.95ea.; 2/\$15.99

QUANTITIES LIMITED!!!



SYNTHESIZER SPEAKERS

As used in the ARP 2600 Synthesizer (4 x 6 inches). Plenty of power capability. Great for cars, replacement, or speaker arrays. Heavy magnet, 40 ohms, oval shape.

Just \$3.99ea.; 3/\$10.00

REVERB ASSEMBLIES

Dual suspension with 4 Different spring sizes. Magnetic transducers, shock-damped spring assembly. Approx. 1 foot long springs for superb delay times.

Reverb Assembly (NEW) ..\$16.50ea.

ATTN: COMPUTER HOBBYISTS

WRITE OR CALL FOR OUR BARGAIN-PACKED PERIPHERAL FLYER!!

**COMPUTERS,
PERIPHERALS,
UNLIMITED!**

WAREHOUSE:
18 Granite St., Haverhill, Mass. 01830

MAIL ORDER:
Box 204, Newton, N.H. 03858

TELEPHONE ORDERS:
617/372-8637

Sorry, No Collect Calls
MasterCharge & VISA Accepted

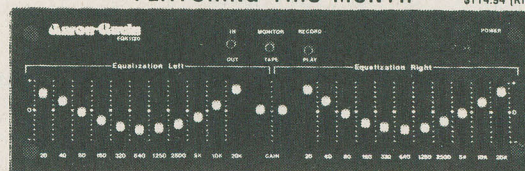
CIRCLE 35 ON FREE INFORMATION CARD

Aaron-Gavin Kits

Equalizers Mixers LED Meters

FEATURING THIS MONTH

\$114.94 (Kit)



The first 11 Band Stereo Equalizer with truly unique LINEAR Mirror Image Circuitry. Totally eliminates snap-on. Generates a TRUE ± 15 db Boost and Cut on EVERY BAND without band to band phase cancellation or rainbow effect.

- Super Low Noise J-Fets ON ALL BANDS • Regulated Power Supply
- Slew Rate: "13 Volts" per microsecond • Built-in Record Switching - no need to re-patch

And as always with Aaron-Gavin Instruments. Lowest Noise. Lowest distortion and Great Over-All PROFESSIONAL Quality.

GRAPHIC EQUALIZERS

Description	Kit	Mfg.
31 Band Stereo EQ	\$279.56	\$544.54
31 Band Mono EQ	\$157.05	\$322.53
21 Band Stereo EQ	\$205.02	\$421.02
21 Band Mono EQ	\$125.05	\$258.64
11 Band Stereo EQ	\$114.94	\$230.00
11 Band Mono EQ	\$75.84	\$151.57
11 Band Stereo EQ (As shown above)	\$129.50	\$249.80
5 Band Stereo EQ	\$74.50	\$148.99
5 Band Mono EQ	\$49.14	\$98.27

LED METERS (All integrated circuits!)

DOT or BAR Pattern, 3 position range switch

Description	Kit	Mfg.
Front panel mount only:		
10 LED (Mono)	\$44.40	\$55.80
20 LED (Stereo)	\$52.20	\$68.00
Cabinet or Rack Mount:		
20 LED (Mono)	\$50.40	\$68.00
40 LED (Stereo)	\$67.00	\$88.60

Down to -71dB!

Holiday prices good only to January 1, 1982.

Order with this Coupon or send for product specifications.

Check box for the item of your choice send check, money order, COD or Visa, Master

Charge. Your card number

Exp. date

Add \$7.00 for shipping and handling. Check Freq. Range: 16Hz-16KHz ☐ 20Hz-20KHz

Check style: Rack Mount ☐ Flat Cabinet ☐ Upright Cabinet

NAME

PHONE

ADDRESS

CITY

STATE

ZIP

Aaron-Gavin, 1901 E. Deere St., Dept. 18, Santa Ana, CA 92705. Phone: (714) 957-8710

CIRCLE 34 ON FREE INFORMATION CARD

4116-4 MEMORY 16K	8 for \$10.00
8164 MEMORY 64K	10.00
8264 MEMORY 64K	12.00
4Kx16 MEMORY board w/64 2101 chips	50.00
MPI 8 inch single side disc drive (OK, used)	175.00
MPI 8 inch dual sided disc drive (OK, used)	350.00
SHUGART 8 inch drive 850 FDD (ok, used)	425.00
MOTOROLA MONITOR 9 inch 115 volt	60.00
MOTOROLA MONITOR 12 inch 115 volt	85.00
Above 2 units accept composite video, no case, used.	
2 units below accept TTL. Hi volt supply only. Used.	
BALL BROS. 12 inch monitor	50.00
BALL BROS. 5 inch monitor, cased, used.	60.00

DATA STATION CONSOLE w/keyboard & 9 inch monitor, power supply. Logic boards broken send for details on this one. \$80.00

IR SCOPE see in the dark, new, portable.	260.00
IR SCOPE KIT pre-assembled, modular	150.00
12 VOLT GEL CELL 2 1/2 AH \$14.00 5 AH	17.00
12 inch CRT bonded face plate, new, with specs.	
Made for computer work. \$25 each 5 for \$100.00	
UNDERWATER HYDROPHONE 200 KC	10.00

WALKY TALKIES Govt surplus used condition. 47-55.4 mc range. With schematics. Govt AN/PRC-6 \$25 each 2 for \$45. Ant. \$5 each

ASCII KEYBOARD parallel \$50
RED LED's 10 for \$1.00

MIN ORDER \$10.00

CATALOG 21 now ready

Shipping extra on all merchandise

Meshna Inc., PO Box 62, E. Lynn, Mass. 01904



CIRCLE 33 ON FREE INFORMATION CARD

VIDEO

36 Channel Up Converter for TV & VTR

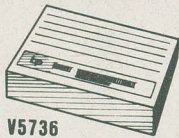
1-3 pieces

\$29⁹⁵ ea.

4 pieces & up

\$24⁹⁵ ea.

Model V5736



- Allows complete programming of VTR
- Watch or record any combination of standard or Pay-TV programs
- Receives Midband and Superband channels on UHF
- For Beta/VHS type recorders

BRUCE 37-Channel Wireless Remote Control TV Tuner

1-5 pcs.

\$109⁹⁵ ea.

6 pcs. & up

\$99⁹⁵ ea.

Reg. \$199.95



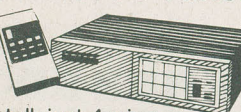
- For all channels; for all TV's
- Red LED channel readout 1-99
- Master power switch and fine tune controls on remote
- Easy to install
- Scan channels up and down

TEKNIKA Wireless Remote Control TV Tuner

\$109⁹⁵ ea.

Reg. \$169.95

Model 6301

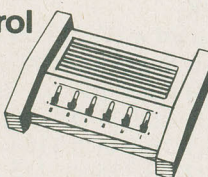


- Easy to install; just 4 wires
- Electronic channel selection and indication. VHF: 2-12, UHF: 14-83,
- Ultra-Infrared Beam Control
- Master power switch

Video Control Center

Model VTS-157

\$59⁹⁵



- No need to change cable to access input to TV set.
- One output; 4 inputs
- No AC power required to operate.
- Auxiliary input and output.

CATV 3D-Channel Remote Control

Model RSC- 8C

\$79⁹⁵

Consists of 2 units: remote control channel selector with fine tuning, ON/OFF switch; and converter body.

TV Accessories

7002 2 Set VHF/FM Amplifier **\$ 9.95** ea.
7004 4 Set VHF/FM Amplifier **\$ 12.95** ea.

Coax Accessories

DCS-A/B CATV/MATV Switch **\$9.00** ea.

FORDHAM

855 Conklin St. Farmingdale, N.Y. 11735

- Master Charge
- BankAmericard
- VISA ■ COD
- Money Order
- Check

N.Y. State residents add appropriate sales tax
Minimum order \$25 plus \$4.50 shipping and handling

TOLL FREE (800)645-9518

in N.Y. State call (516) 752-0050

ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

Free Information Number

Page

41	AMC Sales	136
—	ATV Research	110
3	Active Electronics	109
—	Advance Electronics	24,28-29,30,78,90
6	Advanced Computers	126-127
59	Albia Electronics	32-33
25	All Electronics	124
27	Altex	139
63,55	American Antenna	13,Cover2
28	Ancrona	137
85	Antenna Specialists	105
38	Arkon Electronics	139
60	Armstrong Industries	5
71	B & K Precision Dynascan Corp.	75
73	Bach Co.	107
—	Bagnall Electronics	136
—	Karel Barta	114
37	Beckman—Electro Products Group	Cover 3
—	Bullet Electronics	130
—	CIE, Cleveland Institute of Electronics	34-37
10	Chaney Electronics	115
18	Colorado Electro Optics	117
—	Command Productions	114,116
51,52,53	Communications Electronics	2,9,11
35	Computer Peripherals Unlimited	141
22	Concord Electronics	137
—	Cook's Institute of Electronics	114
—	Dage Scientific Instruments	108
—	Data Service Co.	110
19	Devtronix Organ, Inc.	108
5	Diamondback Electronics	124
—	Digi-Key Corp	113
—	EIA Distributor Product Division	140
80	Eico	107
47	Electra Bearcat	79
23	Electronic Mart	136
78	Electronics Overseas Corp., Inc.	82
30	Electronics Plus	112
43	Electronic Specialists	136
—	Electronic Technology Today	99
81	Enterprise Development Corp.	103
32	Eto	138
62	Etronix	26
—	Fanon/Courier Corp.	136
—	Fordham Radio	82,142
2	Formula International, Inc.	122-123
42	Fuji-Svea, Inc.	110
79	Gladstone Electronics	103
57	Global Specialties	91
—	Global TV	110
20	Godbout Electronics	112
—	Grantham School of Engineering	105
36	Hal-Tronix	132
64	Hameg	98
—,66	Heath	38-39,101
16	Hunttron Instruments, Inc.	93
—	Information Unlimited	114
—	International Communications Co.	110
75	International Crystal Mfg. Co.	104
24	International Electronics Unlimited	114
14	JDR Microdevices	134-135
—	JS & A	25
4	Jameco Electronics	128-129
26	Javan Co.	133
34	Komac Corp.	141
21	H. J. Knapp, Inc.	124
69	Lincomm	41
—	Live Via Satellite	108
—	McGee's Radio	136
—	McKay Dymek Co.	110
82,84,46	Magnavox	1,7,15
33	Meshna, Inc.	141
17	Micro Ace	130
—	Micro Management Systems, Inc.	114
—	Microtenna Associates	108
—	Monarchy Engineering, Inc.	132
44	Mountain West	136
—	NRI, Schools	16-19
—	NTS Schools	84-87
—	Nabih's, Inc.	105
—	Netronics	96-97
39	North American Phillips	42
68	Omega Sales	89
74	Pac-Tec	102
11	Page Digital	118-119
77,40	Paia	98,106
54	Panasonic	31
72	Panavise	100
45	Poly Paks	139
12	Priority One	120-121
49	RCA	81,95

7	Radio Shack	125
8	Ramsey Electronics	131
—	SCR Electronics, Inc.	142
—	Sabadia Exports Corp.	108
83	Sabtronics	77
86	Scanner Associates	104
50	Shure Brothers, Inc.	22
—	Simple Simon	132
61	Simpson Electric Co.	27
48	Sinclair Electronics (Thandar)	83
—	Sinclair Research Ltd.	20-21
70	N. A. Soar	12
13	Solid State Sales	116
—	Spacecoast	110
29	Struntronics Co., Inc.	138
9	Surplus Electronics	111
67	TSE, Hardside	100
76	Techni-Tool	102
31	Tri-Tek	138
15	Vector Electronics, Inc.	93
58	Viz Mfg. Co.	40
—	Wersi	107
56	Zenith	Cover 4

SCR SUPER-BUYS

UPS ANYWHERE IN CONTINENTAL U.S.

① **FREE SCRAMBLER PLANS** plus a brochure describing our new UHF-VHF Conversion Kit are yours just by sending us your name, address and an 18¢ stamp. **FREE**

② **VHF VARACTOR-TUNER.** 300 ohms input. Tunable for Channels 2-to-13. All solid-state. Made by leading name manufacturer. New-surplus. **\$495^{ea.}**

③ **BRAND NAME POWER SUPPLIES.** ±5V/6A. Voltage adjustable and IC regulated. Ideal for CMOS, computer-based instruments, etc. New-surplus. **\$2395^{ea.}**

④ **6-FOOT TELEPHONE CORD** with AMP brand, modular phone-jack at one end, and 4-spade-lug leads at the other. Normally priced at \$2.49 each. **99c^{ea.}**

*Call us for special large quantity pricing quotations.

SCR ELECTRONICS INC. (714) 527-2554 • (213) 596-7553

9533 Valley View Street, Cypress, CA 90630

\$10.00 MIN. ORDER **HANDLING/SHIPPING \$5.00**

Pay by **CHECK, M.O., VISA, M/C, C.O.D.**

MOVING?

Don't miss a single copy of **Radio-Electronics**. Give us:

Six weeks' notice

Your old address and zip code

Your new address and zip code

ATTACH LABEL HERE

name (please print)

address

city state zip code

Mail to: Radio-Electronics
SUBSCRIPTION DEPT., P.O. BOX 2520,
BOULDER, COLO. 80322

FOR FREE INFORMATION USE THESE POST-PAID CARDS

1

Print your name, address and Zip Code on one of the attached post-age-paid cards.

2

Circle the number (or numbers) on the card that corresponds to the number at the bottom of each advertisement or editorial item that you want information on. Advertisers' free-information numbers also appear in the ad index at the left on the facing page.

3

Mail the card. It's Postage-Paid.

NOTE:

Use the postcard address for Free Product Information only. Address all editorial inquiries to Editor, RADIO-ELECTRONICS, 200 Park Avenue South, New York, N.Y. 10003.

POSTAGE-PAID FREE INFORMATION CARD Only one card per person.

REA1281

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
2	12	22	32	42	52	62	72	82	92	102	112	122	132	142	152
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143	153
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144	154
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146	156
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147	157
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149	159
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

1 ☐ Please send me 12 issues of R-E for \$13.00 and bill me. (Canada \$16.00—US Funds only)

NAME Please print. _____

COMPANY NAME (If applicable) _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

IMPORTANT

VOID after February 28, 1982

Allow 6-8 weeks for delivery of first issue



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 597 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE

Radio-Electronics®

SUBSCRIPTION SERVICE

P.O. Box 2520

BOULDER, COLORADO 80321

POSTAGE-PAID FREE INFORMATION CARD Only one card per person.

REA1281

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
2	12	22	32	42	52	62	72	82	92	102	112	122	132	142	152
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143	153
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144	154
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146	156
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147	157
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149	159
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

1 ☐ Please send me 12 issues of R-E for \$13.00 and bill me. (Canada \$16.00—US Funds only)

NAME Please print. _____

COMPANY NAME (If applicable) _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

IMPORTANT

VOID after February 28, 1982

Allow 6-8 weeks for delivery of first issue



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 217 CLINTON, IOWA

POSTAGE WILL BE PAID BY ADDRESSEE

Radio-Electronics®

FREE PRODUCT INFORMATION

P.O. Box 2707

CLINTON, IOWA 52735



RADIO-ELECTRONICS

Subscribe today to the magazine that keeps you up-to-date with the newest ideas and innovations in electronics. (If you already are a subscriber, do a friend a favor and pass this subscription card along to him.)

check offer preferred

☐ 1 Year—12 issues **ONLY \$13.00**
(You save \$2.00 over newsstand)

☐ 2 Years (**SAVE MORE**)—24 issues **\$25.00**
(You save \$5.00 over newsstand)

☐ Canada—12 issues \$16.00

☐ Canada—24 issues \$31.00

☐ Payment enclosed

☐ Bill Me

☐ Check here if you are extending or
renewing your subscription

All other countries \$7.50 per year.

US FUNDS ONLY

Name (Please Print) _____

Company Name (If applicable) _____

Address _____

City _____

State _____

Zip _____

IMPORTANT

Allow 6-8 weeks for delivery of first issue

4SM1



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 217 CLINTON, IOWA

POSTAGE WILL BE PAID BY ADDRESSEE

Radio-Electronics®

FREE PRODUCT INFORMATION

P.O. Box 2707

CLINTON, IOWA 52735



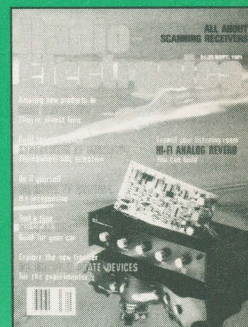
For new ideas in electronics read Radio- Electronics

During the next 12 months

Radio-Electronics
will carry up-to-the-
minute articles on:

- hobby computers
- solid-state technology
- TV games • Video
- color TV • stereo
- test equipment
- radio
- radar detectors
- industrial electronics
- servicing
- TV-radio-stereo
- experimenter
circuits
- exceptional
construction
projects

Don't take a
chance on missing
even one issue.
Subscribe now
and save!



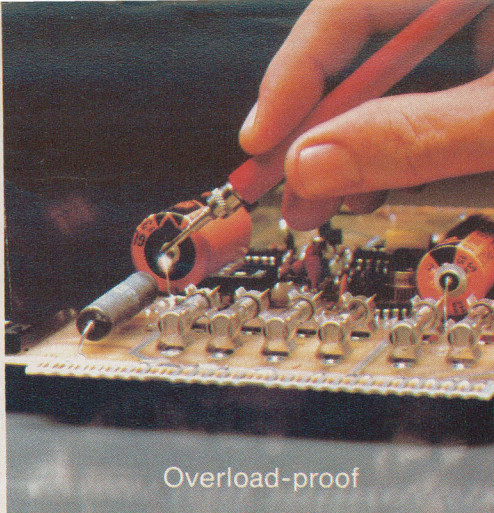
NEW IDEAS AND
INNOVATIONS IN
ELECTRONICS

The newest ideas and
innovations in
electronics appear in
Radio-Electronics.
Keep up-to-date!

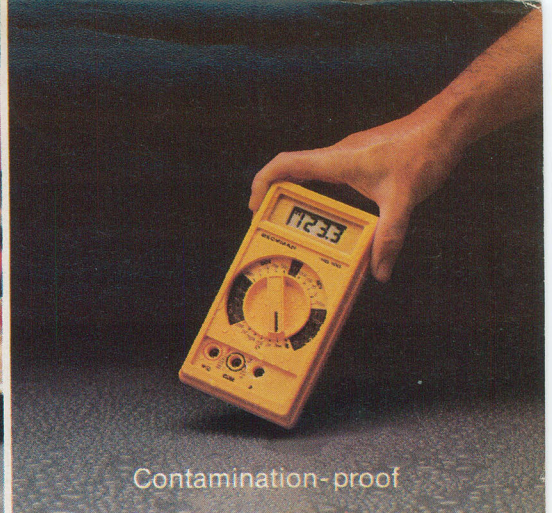
Subscribe Today!



Drop-proof



Overload-proof



Contamination-proof

Oops proof.

Now there's a hand-held DMM tough enough to withstand accidental drops, destructive environments, and input overloads—and still give you superior Beckman performance.

The HD-100 from Beckman is drop-proof, sealed against contam-

ination, and packed with overload protection. You won't find a more rugged meter inside or out.

Drop-proof

Constructed of double-thick thermoplastics, the HD-100 resists damage even after repeated falls. All components are heavy duty and shock mounted.

Water- and contamination-proof

The HD-100 is designed to keep working even around dirt, heavy grime and moisture.

The special o-ring seals, ultrasonically-welded display window and sealed input jacks protect the internal electronics of the HD-100 from any source of contamination. The HD-100 is sealed so tightly, it's even waterproof.

Accidental overload protection

All voltage inputs are protected up to 1500 Vdc or 1000 Vrms. Current ranges are protected to 2A/250V with resistance ranges protected to 600 Vdc. Transient protection extends up to 6KV for 10 micro-seconds.

More meter for the money

For starters you get 2000 hours of continuous use off a common 9V transistor battery. You can run in-circuit diode tests and check continuity. You even get a one year warranty.

The 0.25% basic volt dc accuracy HD-100 serves you with 7 functions and 29 ranges. With one simple turn of the single selector switch, you can go directly to the function and range you need. There's less chance of error.

Feature for feature you can't find a more dependable meter priced at just \$169 (U.S. only).

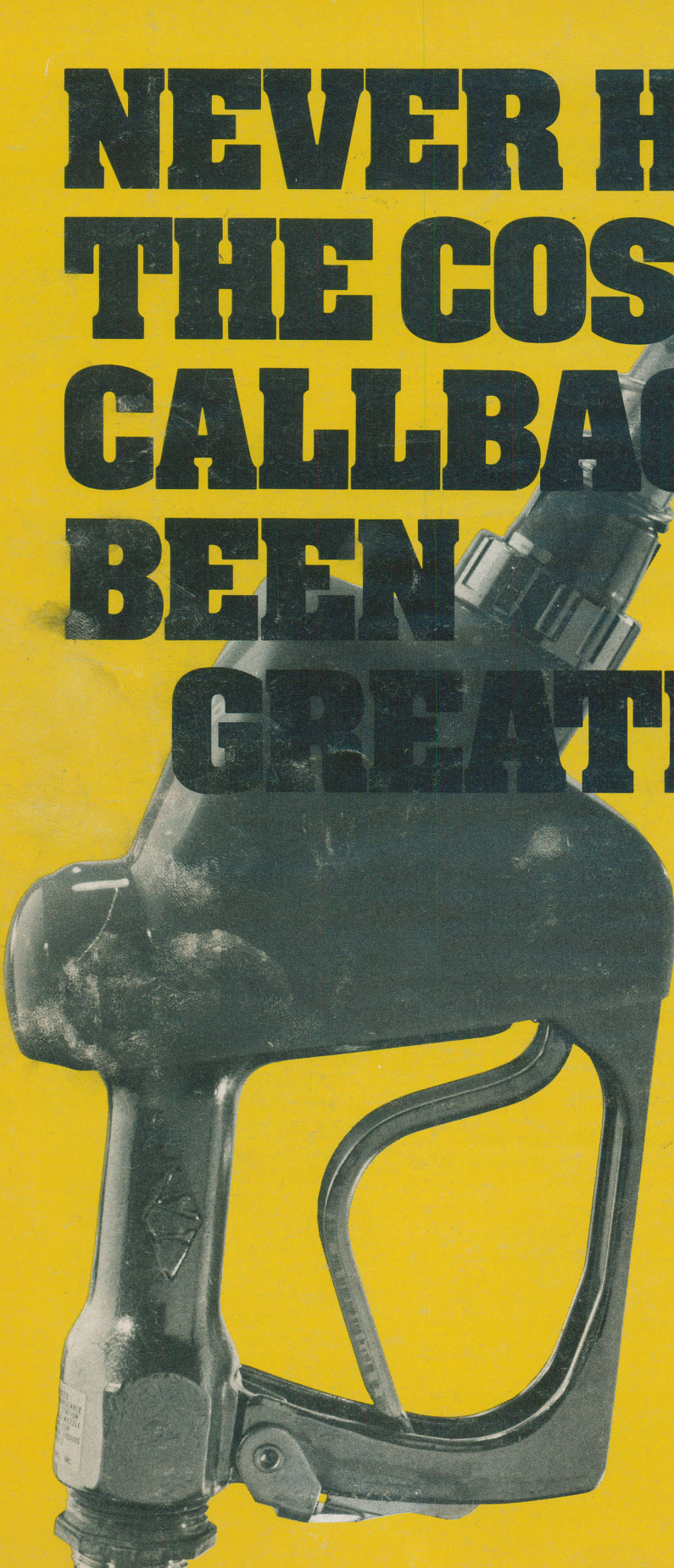
To locate your nearest distributor write Beckman Instruments, Inc., Instrumentation Products, 2500 Harbor Boulevard, Fullerton, CA 92634 or call (714) 993-8803.



BECKMAN

CIRCLE 37 ON FREE INFORMATION CARD

NEVER HAS THE COST OF CALLBACKS BEEN GREATER!



Think what runaway fuel costs are doing to your bottomline. On callbacks alone. Better yet, don't just think. Do something.

Take advantage of your Zenith distributor's exchange program for genuine Zenith replacement modules, tuners, channel selectors, and sub-assemblies.

It's one sure way to keep a Zenith all-Zenith. With replacements remanufactured for reliability by Zenith people as expert as those who made the originals.

See your Zenith distributor now about an exchange program for Zenith replacement modules, tuners, channel selectors, and sub-assemblies no "outside" source can match!

Call now before another costly callback cuts deeper into your bottomline!

Always insist on Zenith exact replacement parts, tubes and accessories.

ZENITH
®

The quality goes in before the name goes on®

Zenith Radio Corporation/Service, Parts & Accessories Division/11000 Seymour Avenue/Franklin Park, Illinois 60131

CIRCLE 56 ON FREE INFORMATION CARD